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### **Severe Wind**

Wind can be one of the most destructive forces of nature. Strong winds can erode mountains and shorelines, topple trees and buildings, and destroy a community's critical utilities and infrastructure. Primarily, damaging winds that affect the Richmond Regional Planning District are associated with hurricanes or tropical storms (or their remnants). Tornadoes also have caused damage throughout the study area, though these are often caused by hurricanes or tropical storms. In addition, high winds may be associated with severe thunderstorms.

The recurrence interval for wind events is derived from the number of direct and indirect landfall "hits" a community takes from hurricanes, tornados, and reports of high winds. Since 1790, the Richmond region has experienced 285 significant wind events. This makes for a recurrence interval of 1.3 years. While 154 events have been recorded over the past twenty years, the apparent increase in events is likely attributable to better record-keeping than to an actual increase in the number of events. Table V-10 provides a breakdown on the number of events per jurisdiction. Power outages tend to be the greatest issue related to severe wind as opposed to structural damages.

Table V-10 — Severe Wind Events by Jurisdiction		
Jurisdiction	1790-2004 Count	1984-2004 Count
<i>Charles City County</i>	40	24
<i>Goochland County</i>	76	37
<i>Hanover County including Town of Ashland</i>	97	58
<i>Henrico County</i>	122	56
<i>New Kent County</i>	70	37
<i>Powhatan County</i>	64	31
<i>City of Richmond</i>	78	26
<i>Sources: NOAA/National Climatic Data Center. U.S. Storm Event Database; VDEM; SHELDUS</i>		
<i>*Note: Separate data for Ashland not available</i>		

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The majority of events reported in the National Climatic Data Center Storm Event database for Henrico County were related to thunderstorm winds. It should be noted that this table only includes those wind events that were reported and recorded. The accuracy of the information is based on the accuracy of the reporting and recording; more recent events may be more thoroughly recorded. In addition, variations in the data could occur due to varying reporting practices. For instance, Charles City and New Kent counties are contiguous and are believed by county officials to be impacted by the same storms. The number of recorded wind events, however, differs between the two jurisdictions.

*Tropical Cyclones (Hurricanes)*

A tropical cyclone is a low-pressure area of closed circulation that forms over a large tropical body of water. Tropical cyclones rotate counterclockwise throughout the Northern Hemisphere and are called tropical depressions when their wind speed is less than 39 mph, but become tropical storms when their wind speeds are between 39 mph and 73 mph. When these wind speeds reach 74 mph they become hurricanes.

The hurricane season in the North Atlantic runs from June 1 until November 30, with the peak season between August 15 and October 15. The average hurricane duration once it makes landfall is 12 to 18 hours. Wind speeds may be reduced by 50% within 12 hours after the storm reaches land. These storms are capable of producing a large amount of rain in a short period; as much as 6 to 12 inches of rain has occurred within a 12 to 16 hour timeframe. Hurricanes also can spawn tornadoes.

The strength of a hurricane is classified according to wind speed using the Saffir-Simpson Hurricane Damage Scale. This scale is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the scale, as storm surge values are highly dependent on the slope of the continental shelf in the landfall region. Table V-11 provides a description of typical damages associated with each hurricane category.

The Richmond region has experienced approximately ten major hurricane-related events over the past 100 years. The recurrence interval is approximately 10 years. Three of these events were mainly wind events while the damages from the other seven resulted mainly from flooding. The latter events were described in the previous section and will not be repeated in this section. Full details are provided in Appendix D.

Figure V-29 shows the tracks of tropical cyclones that have directly affected the study area since 1950. The green and yellow lines represent tropical depressions and tropical storms, respectively. The red lines represent Category 1-3 hurricanes. As the figure shows, the majority of tropical cyclones in the Richmond region have had relatively low wind speeds.

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Figure V-29 -- Historic Tropical Cyclone Storm Tracks<sup>28</sup>

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<sup>28</sup>NOAA Coastal Services Center. Retrieved from <http://hurricane.csc.noaa.gov/hurricanes/viewer.htm>

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**TABLE V-11 — Saffir-Simpson Hurricane Damage Scale**

CATEGORY	Wind Speed (mph)	Description of Typical Damages
1	74-95	Minimal damage — Storm surge generally 4-5 feet above normal. No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Some damage to poorly constructed signs. Also, some coastal road flooding and minor pier damage.
2	96-110	Moderate damage — Storm surge generally 6-8 feet above normal. Some damage to buildings. Considerable damage to shrubbery and trees with some trees blown down. Considerable damage to mobile homes, poorly constructed signs, and piers. Coastal and low-lying escape routes flood 2-4 hours before arrival of the hurricane center. Small craft in unprotected anchorages break moorings.
3	111-130	Extensive damage — Storm surge generally 9-12 feet above normal. Some structural damage to small residences and utility buildings. Damage to shrubbery and trees with foliage blown off trees and large trees blown down. Mobile homes and poorly constructed signs are destroyed. Low-lying escape routes are cut off by rising water 3-5 hours before arrival of the center of the hurricane. Flooding near the coast destroys smaller structures with larger structures damaged by battering from floating debris. Terrain continuously lower than 5 feet above mean sea level may be flooded inland 8 miles (13 km) or more. Evacuation of low-lying residences may be required.
4	131-155	Extreme damage — Storm surge generally 13-18 feet above normal. More extensive structural failures on small residences. Shrubs, trees, and all signs are blown down. Complete destruction of mobile homes. Extensive damage to doors and windows. Low-lying escape routes may be cut off by rising water 3-5 hours before arrival of the center of the hurricane. Major damage to lower floors of structures near the shoreline. Terrain lower than 10 feet above sea level may be flooded requiring massive evacuation of residential areas as far inland as 6 miles (10 km).
5	>155	Catastrophic damage — Storm surge generally greater than 18 feet above normal. Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. All shrubs, trees, and signs blown down. Complete destruction of mobile homes. Severe and extensive window and door damage. Low-lying escape routes are cut off by rising water 3-5 hours before arrival of the center of the hurricane. Major damage to lower floors of all structures located less than 15 feet above sea level and within 500 yards of the shoreline. Massive evacuation of residential areas on low ground within 5-10 miles of the shoreline may be required.

Source: United States Coast Guard

### Tornadoes

Although relatively infrequent, tornadoes do occur in the study area. If a tornado were to impact the planning district, the level of damages sustained would depend most on the strength of the tornado, measured by the Fujita Scale, along with the type and number of



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facilities and resources impacted. Table V-12 includes the corresponding wind speeds for the Fujita Scale, and typical damage descriptions for each level.

Twenty-one tornadoes have struck the Richmond region in the last 100 years. Based on this information, the recurrence interval for tornadoes in the Richmond region is approximately 4.8 years.

Table V-12 — The Fujita Scale		
Scale Value	Wind Speed (mph)	Description of Typical Damage
F0	40-72 mph	Some damage to chimneys and signs, shallow rooted trees pushed over.
F1	73-112 mph	Surfaces peeled off roofs, mobile homes overturned, autos pushed off roads.
F2	113-157 mph	Roofs torn from frame houses, mobile homes demolished, large trees uprooted.
F3	158-206 mph	Roofs and walls torn off well-built houses, trains overturned, most trees uprooted, heavy cars lifted and thrown.
F4	207-260 mph	Well built houses leveled, structures with weak foundations blown some distance, cars thrown and large missiles of debris generated.
F5	261-318 mph	Strong frame houses lifted off foundations and disintegrated and debris carried considerable distances, automobile sized missiles fly through the air in excess of 300 feet, trees debarked.
<i>Source: National Weather Service</i>		

### Thunderstorms

Thunderstorms affect relatively small areas when compared with hurricanes and winter storms. The typical thunderstorm is 15 miles (24 kilometers) in diameter and lasts an average of 20 to 30 minutes. Of the estimated 100,000 thunderstorms occurring each year in the United States, only about 10 percent are classified as severe.

Thunderstorms may occur singly, in clusters, or in lines. Some of the most severe weather occurs when a single thunderstorm affects one location for an extended time. The National Weather Service (NWS) considers a thunderstorm severe if it produces hail at least three-quarters of an inch (2 centimeters) in diameter, has wind gusts of 58 miles (93 kilometers) an hour or higher, or produces a tornado.

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Downbursts and straight-line winds associated with thunderstorms can produce winds of 100 to 150 miles (161 to 241 kilometers) per hour—enough to flip cars, vans, and pickup trucks. The resulting damage can equal the damage of most tornadoes.<sup>29</sup>

## **Hazard History**

### 18<sup>th</sup> Century

A tornado on April 6, 1790, was the first severe wind event recorded for the Richmond region. The tornado struck Charles City and Dinwiddie counties, destroying four mills and blowing down four houses at the New Glass Manufactory.

### 19<sup>th</sup> Century

A tornado on July 27, 1816, killed two and injured three in Henrico County where it was on the ground about 14 miles.<sup>30</sup> Less than a year later, a tornado touched down in Henrico County on June 4, 1817. It moved east from the southern part of Chickahominy (about 15 miles north of downtown Richmond) across Henrico County to the Pamunky River in King William County, causing widespread destruction. The 200-300 yard wide tornado killed one person killed and injured four in Hanover; another was killed in King William County.<sup>31</sup>

The first recorded hurricane that affected the Richmond region was in August 1827. This storm caused damage from Charleston to Baltimore. Fifty years later, a strong storm (similar to Hurricane Hazel 75 years later) passed through the region causing downed trees and roof damage. A hurricane in September 1896 caused 16 deaths and almost \$4 million in damages along the eastern seaboard. The hurricane spawned tornadoes in the Richmond region and brought torrential rain.<sup>32</sup>

### 20<sup>th</sup> Century

An F3 tornado struck the heart of Richmond on June 13, 1951. It left a four mile path of damage that sent a dozen people to the hospital, injured scores more, and left over a hundred homeless. Thirty-five buildings were destroyed, 126 received major damage and hundreds more had moderate to minor damage. Damage estimates were over one million dollars. The tornado was seen tossing a car 30 to 40 feet into the air. Eyewitness accounts were reported in the next day's Richmond News Leader. John L. Walker said, "Four different clouds - all funnel-shaped - were rushing toward the city. Each one had a tail like a kite. Then the four

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<sup>29</sup> *Talking About Disaster: Guide for Standard Messages.*

<sup>30</sup> Watson, Barbara McNaught. *Virginia Tornadoes*. Retrieved from <http://www.vdem.state.va.us/library/vatorn/va-tors.htm>.

<sup>31</sup> *Virginia Tornadoes*.

<sup>32</sup> Watson, Barbara McNaught. *Virginia Hurricanes*. Retrieved from <http://www.vdem.state.va.us/library/vahurr/va-hurr.htm>.

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came together in the shape of a huge auger that picked up everything in front of it." This report suggests that it was a multi-vortex tornado with, at one point, four vortices visible.<sup>33</sup>

The next hurricane of note was Hurricane Hazel in October 1954. Peak gusts in the Richmond region were 79 miles per hour with sustained winds of 68 mph. Four people died when a tug capsized on the James River about 25 miles from Richmond. Piers were demolished and private docks swept away in the Tidewater rivers. In addition, two hundred plate glass store fronts in Richmond were broken.<sup>34</sup>

September 1955 and 1960 saw more hurricanes in the Richmond region. Beginning in 1956, the National Weather Service also began documenting thunderstorm winds on a more regular basis. Reports of thunderstorm winds average every few months for various jurisdictions in the study area. Generally, these events cause damage to trees and utility lines often resulting in power outages and road blockages. A full description of the various events is presented in Appendix D.

May 8, 1984, saw another notable tornado move through the study area. It began as an F3 in the City of Hopewell but continued into Charles City County as an F2 adding another 15 miles to its damage path. Severe downburst winds accompanied the storms leaving a total damage path 10 miles wide. At least a thousand trees were lost. In New Kent, three mobile homes, a barn and outbuildings were destroyed or damaged and a boy was injured by a falling tree.<sup>35</sup>

Table V-13 summarizes historical tornado occurrences in the counties within the study area. Approximately 29 tornadoes have been recorded over the past 211 years, making for a recurrence interval of 7.3 years. In addition, the number of actual tornadoes may be under or overestimated because of reporting protocol. Tornadoes may be overcounted if the same tornado touches down in multiple locations. Tornadoes, however, are typically only recorded if they cause damages; therefore, the number of tornadoes may be undercounted. Many of the tornadoes reported were F0 or F1 in strength.

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<sup>33</sup> *U.S. Storm Event Database. Virginia Tornadoes.*

<sup>34</sup> *Virginia Hurricanes.*

<sup>35</sup> *Virginia Tornadoes.*

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Table V-13 — Tornadoes from 1790-2004	
Jurisdiction	Count
<i>Charles City County</i>	3
<i>Goochland County</i>	11
<i>Hanover County including Town of Ashland</i>	8
<i>Henrico County</i>	8
<i>New Kent County</i>	5
<i>Powhatan County</i>	2
<i>City of Richmond</i>	8
<i>Sources: NOAA/National Climatic Data Center. U.S. Storm Event Database; VDEM; SHELDUS</i>	
<i>*Note: Separate data for Ashland not available</i>	

## **Wind Zones**

The Richmond region is categorized by the American Society of Civil Engineers in its *Minimum Design Loads for Buildings and Other Structures* (ASCE 7) as a 90-mph wind zone, based on a 50-year recurrence interval. Based on ASCE 7, the potential wind speed for an event with a 100-year recurrence interval was estimated to be 107% of the 50-year wind speed, or 96.3 mph. The Virginia Uniform Statewide Building Code requires the minimum design wind speed for the study area to be 90 mph.

High wind events have occurred in every portion of the study area. There are no proven indicators to predict specifically where high winds may occur, and wind events can be expansive enough to affect the entire area. The counties on the eastern side of the planning area are marginally closer to the coast so might experience higher wind speeds from tropical storms or hurricanes that make landfall on the Virginia coast.

FEMA's Hazards US, multi-hazard loss estimation software (HAZUS-MH) was used to develop wind speeds for various probabilistic hazard scenarios. As can be seen from the maps (Figures V-30 to V-32), wind speeds are determined by the track of the storm, which can vary. For a 50-year event, wind speeds vary no more than 8 miles per hour across the study area. This difference increases dramatically when considering the 100-year and 500-year events. For the 100-year event, the maximum wind speed ranges from 55 to 109 miles

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per hour (a difference of 54 mph). The range for the 500-year event is 85 to 124 miles per hour (a difference of 39 mph). The maps also show that the probable storm track differs significantly between the events. HAZUS-MH only provides mapping for cities and counties, therefore, the Town of Ashland is not included on the wind speed or loss estimate maps.

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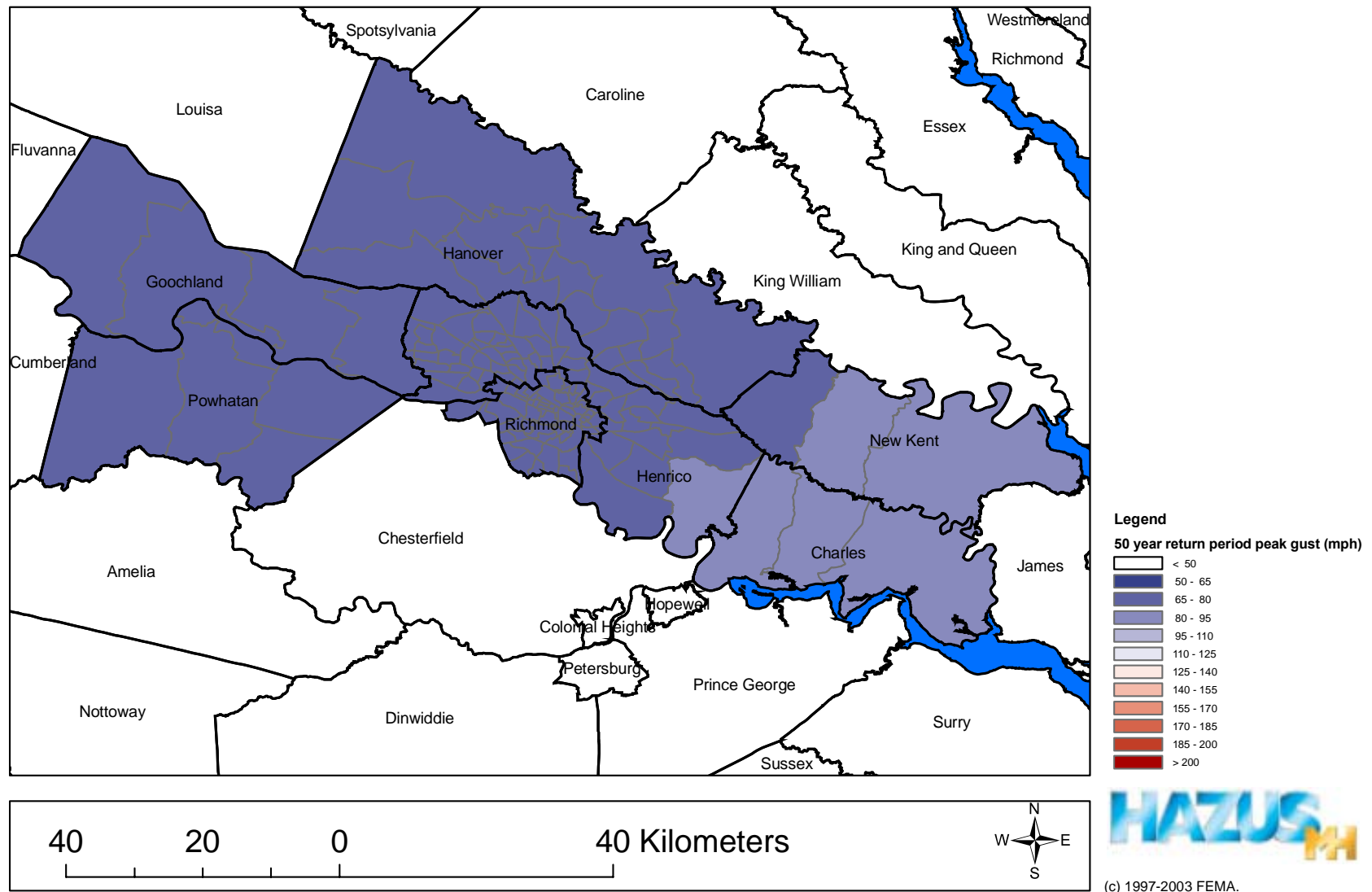


Figure V-30 – Wind Speeds for 50-Year Event

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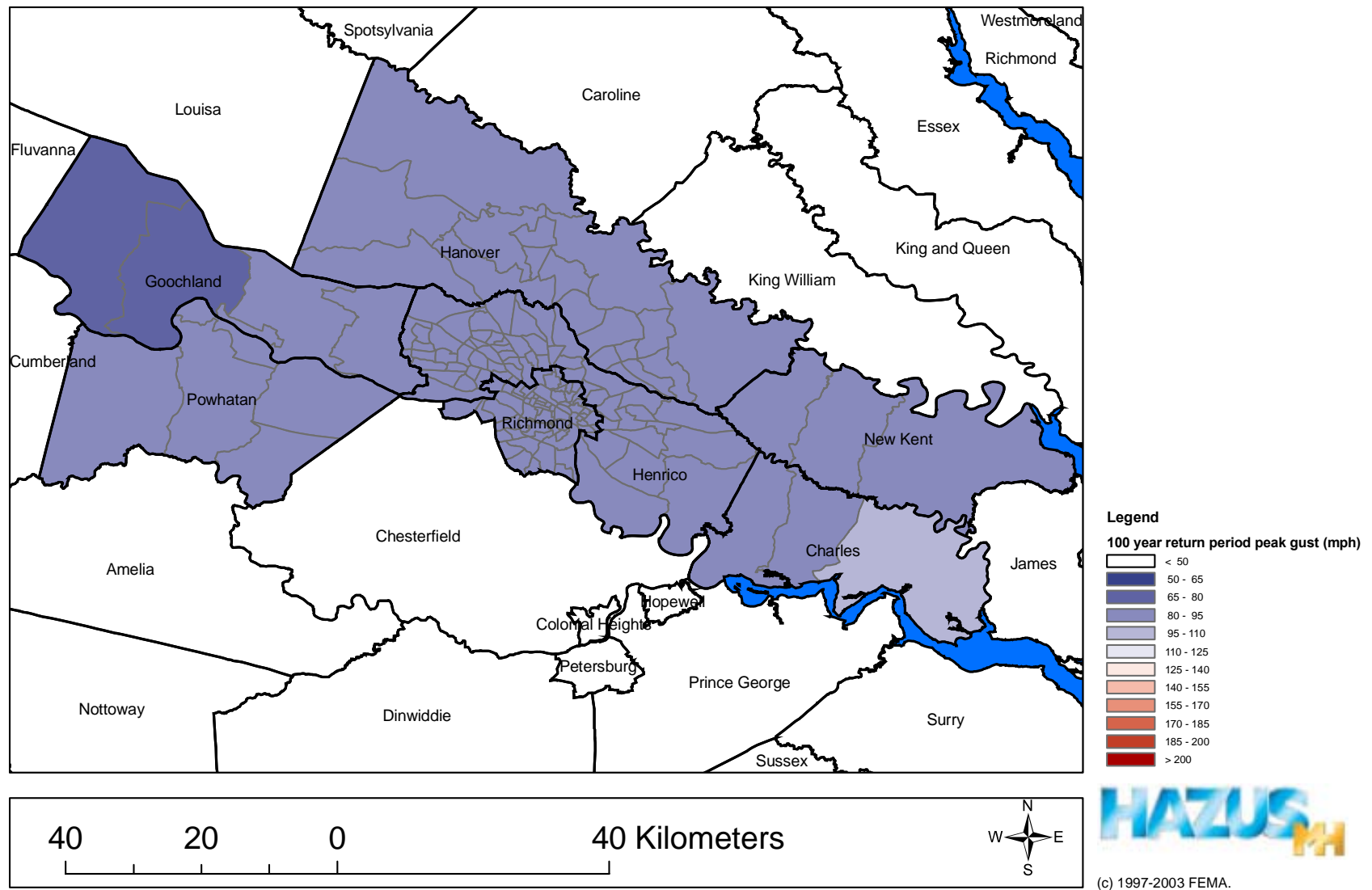


Figure V-31 – Wind Speeds for 100-Year Event

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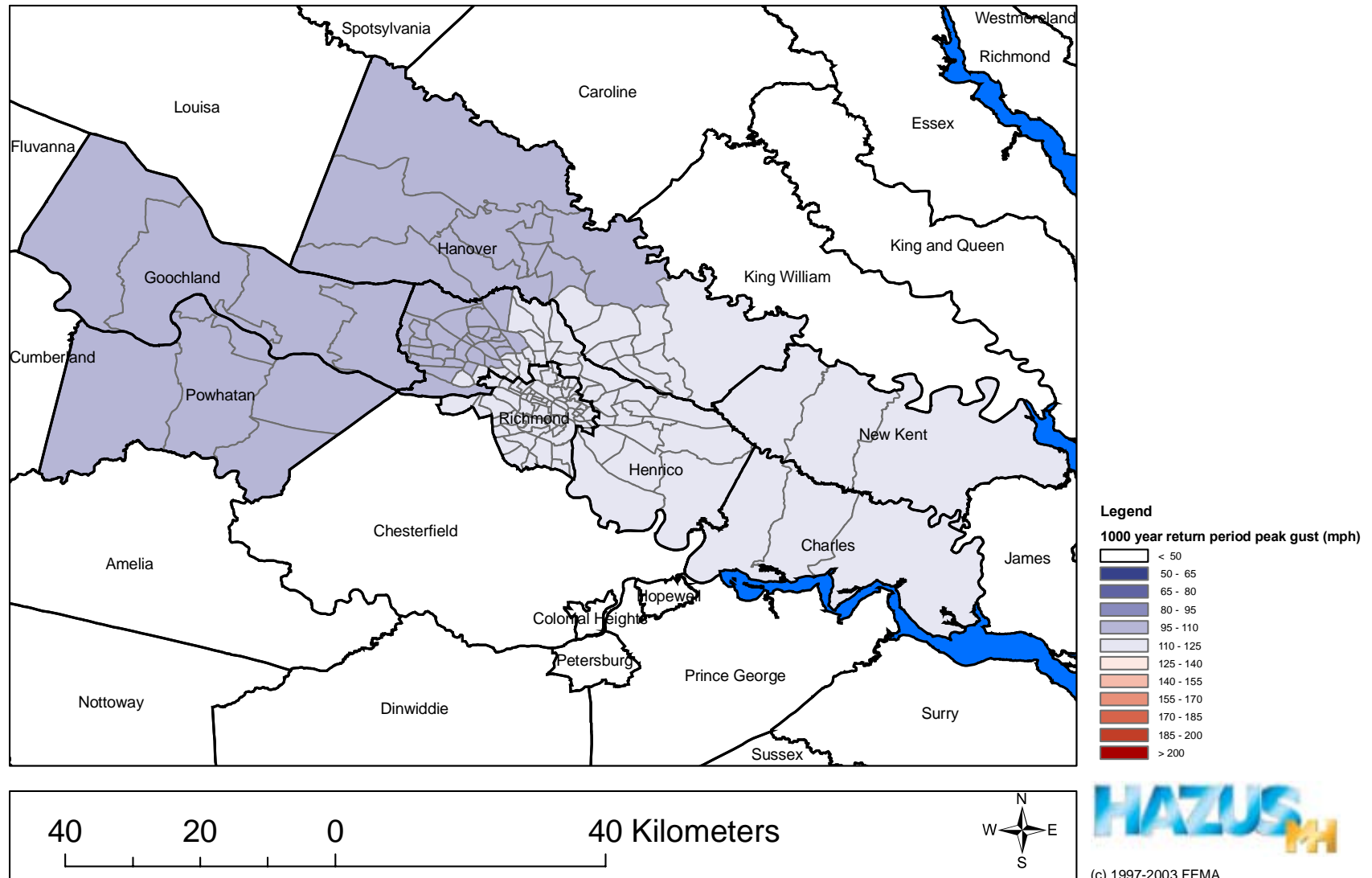


Figure V-32 – Wind Speeds for 1000-Year Event



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Given the hazard history and the HAZUS results, the eastern portion of the study area has a slightly higher risk for wind events because of its proximity to the coast and higher wind speeds from the eastern edge of tropical cyclones.

### **Vulnerability Analysis**

Depending on the type of wind event, the damage sustained can range from extremely localized to wide spread, and from moderate to devastating. The potential impacts of a severe wind event to the study area depend on the specific characteristics of the event but can include broken tree branches and uprooted trees; snapped power, cable, and telephone lines; damaged radio, television, and communication towers; damaged and torn off roofs; blown out walls and garage doors; overturned vehicles; totally destroyed homes and businesses; and serious injury and loss of life. Downed trees and power lines can fall across roadways and block key access routes, as well as cause extended power outages to portions of the study area.

The extent and degree of damages from a high wind event are primarily related to the intensity of the event, measured in terms of wind speed. Sustained high winds can be the most damaging, although a concentrated gust can also cause significant damage. As wind speeds increase, the extent of damage varies depending on a number of site-specific characteristics that will be discussed later in this section.

Although no specific areas of the study area can be designated as having a higher risk of being affected by a severe wind event, there are a number of factors that contribute to a particular area's vulnerability to damages if a high wind event should occur. Certain characteristics of an area or of a structure increase its resistance to damages than other characteristics. Many of these factors are extremely specific to the particular location, or the particular structure in question. However, each factor's affects on vulnerability can be discussed in general. The following is a list of these factors and a description of how they relate to vulnerability, particularly in the study area.

#### **Design Wind Pressures**

Buildings must be designed to withstand both external and internal wind pressures on the structural framing and exterior elements. The level to which these structures are designed, as expected, directly correlates with their ability to resist damages due to high winds. The State's building code dictates design wind speed for structures. As described in the previous "Wind Zones" section, the design wind speed for the study area is 90 mph. Structures constructed subsequent to the adoption of the building code are the most likely to be the most resistant to damages from wind. However, the resistance to wind damage based on these code requirements is only effective to the level the requirements are enforced. No

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comprehensive data on the date built for structures or code enforcement exists for the planning district.

**Building Types**

The type of building construction will have a significant impact on potential damages from high wind events. A summary of basic building types – listed in order of decreasing vulnerability (from most to least vulnerable) – is provided below.

- **Manufactured:** This building type includes manufactured buildings that are produced in large numbers of identical or smaller units. These structures typically include light metal structures or mobile homes.
- **Non-Engineered Wood:** Wood buildings that have not been specifically engineered during design. These structures may include single and multi-family residences, some one or two story apartment units, and small commercial buildings.
- **Non-Engineered Masonry:** Masonry buildings that have not been specifically engineered during design. These structures may include single and multi-family residences, some one or two story apartment units, and some small commercial buildings.
- **Lightly Engineered:** Structures of this type may combine masonry, light steel framing, open-web steel joists, wood framing, and wood rafters. Some portions of these buildings have been engineered attention while others have not. Examples of these structures include motels, commercial, and light industrial buildings.
- **Fully Engineered:** These buildings typically have been designed for a specific location, and have been fully engineered during design. Examples include high-rise office buildings, hotels, hospitals, and most public buildings.

The Richmond region includes a variety of building types. The primary residential construction type is wood framed, varying from single story to multiple stories, although some masonry and steel properties are present as well. As mentioned in the list above, non-engineered wood framed structures are among the most susceptible to potential damage. With this type of construction being the most prevalent for properties in the planning district, a majority of structures in the area could be classified to have a high level of vulnerability to damages should a high wind event occur. Table V-14 shows the number of buildings in each jurisdiction by construction or building type. HAZUS-MH does not provide data specifically at the town level. To approximate the exposure for the Town of Ashland, two census tracts (i.e., 51085320601 and 51085320602) that cover the majority of

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the town were used. It should be noted that the Hanover County numbers include the Town of Ashland.

<b>Table V-14 – Number of Buildings by Building Type</b>						
<b>Jurisdiction</b>	<b>Wood</b>	<b>Masonry</b>	<b>Concrete</b>	<b>Steel</b>	<b>MH</b>	<b>Total</b>
<i>Charles City</i>	1,679	560	-	2	558	2,799
<i>Goochland</i>	4,904	1,646	9	23	450	7,032
<i>Hanover</i>	23,984	8,120	54	224	829	33,211
<i>Town of Ashland</i>	1,167	415	17	44	328	1,971
<i>Henrico</i>	66,800	22,873	264	682	447	91,066
<i>New Kent</i>	3,787	1,266	2	7	332	5,394
<i>Powhatan</i>	5,600	1,884	10	20	210	7,724
<i>Richmond</i>	41,696	14,857	438	874	651	58,516
<i>Grand Total</i>	148,450	51,206	777	1,832	3,477	205,742
<i>Sources: HAZUS-MH; Census 2002</i>						

Manufactured buildings account for approximately 2% of the building stock in the study area. Manufactured buildings, however, make up approximately twenty percent of the building stock in Charles City County. Goochland and New Kent counties have the second largest percentage at six percent.

Table V-15 presents the number of buildings by occupancy type. Residential uses dominate the Richmond region in all jurisdictions. As seen in the table, the building count may be underestimated or buildings may be classified incorrectly. For example, HAZUS-MH only counts 14 educational facilities in the Richmond region. In addition, it should be noted that the Hanover County numbers include the Town of Ashland.

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**Table V-15 – Number of Buildings by Occupancy Type<sup>36</sup>**

<b>Jurisdiction</b>	<b>Residential</b>	<b>Commercial</b>	<b>Industrial</b>	<b>Agricultural</b>	<b>Religious</b>	<b>Government</b>	<b>Education</b>	<b>Total</b>
<i>Charles City</i>	2,799	2	-	-	-	1	-	2,802
<i>Goochland</i>	6,999	34	1	1	5	5	-	7,045
<i>Hanover</i>	32,774	363	70	4	15	7	-	33,233
<i>Town of Ashland</i>	1,890	62	16	-	-	3	-	1,971
<i>Henrico</i>	89,845	1,048	153	1	37	21	-	91,105
<i>New Kent</i>	5,383	11	1	-	1	-	-	5,396
<i>Powhatan</i>	7,697	27	5	-	1	2	-	7,732
<i>Richmond</i>	57,058	1,161	102	2	41	181	14	58,559
<i>Grand Total</i>	202,555	2,646	332	8	100	217	14	205,872

*Sources: HAZUS-MH; Census 2002*

Other building related factors that impact the potential for damage include height, shape, and the integrity of the building envelope. Taller buildings and those with complex shapes and complicated roofs are subject to higher wind pressures than those with simple configurations. The building envelope is composed of exterior building components and cladding elements including doors and windows, exterior siding, roof coverings, and roof sheathing. Any failure or breach of the building envelope can lead to increased pressures on the interior of the structure, further damage to contents and framing, and possible collapse.

### **Potential Impacts**

In the Richmond region, wind events typically cause damage to trees, which then cause damage to power lines causing outages. The debris created by the trees also blocks roads. Clean-up of the debris is often complicated because responsibility is shared in most counties by the Virginia Department of Transportation and private utility companies (i.e., Dominion Virginia Power, Southside Electric Cooperative). In the City of Richmond and Henrico County, responsibility for road maintenance lies with the local jurisdiction. The vulnerability of power infrastructure varies from jurisdiction to jurisdiction.

<sup>36</sup> The discrepancy in total exposure numbers by jurisdiction is due to rounding errors inherent to the HAZUS-MH software.

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*Charles City County*

No jurisdiction-specific information was available for Charles City County.

*New Kent*

Some counties, such as New Kent, operate on a looped power grid that has built-in redundancy that greatly reduces the likelihood that customers will lose service during a severe wind (or other) event.

*Goochland County*

Other counties do not operate on such systems and identified substations that, if they were lost, would severely affect the county's residents. For instance, Goochland County is served by the Crozier substation and another substation located in Henrico County (west of Short Pump Town Center) that follows along I-64 into Crozier. The loss of either of these substations would be significant.

*Hanover County*

The Elmont power substation, located off of Route 1, is the main feeder for Hanover County. In addition, the Ashcake substation provides power to a large portion of Hanover County. Loss of either of these substations would have a significant negative impact on the county. The Doswell cogeneration plant, located near Kings Dominion, also is a major power source. Ice and wind pose a serious threat to power lines, particularly in the western part of the county where tree trimming is needed.

A number of Hanover County radio towers have been subject to past damages. In particular, the tower at Pole Green Park, which serves as the relay between both sides of the county, was damaged. Replacement parts for this tower are no longer available so any damage to the tower is of serious concern.

The county uses schools as shelter facilities but has had limited shelter populations from winter storms over the past six to seven years. The county does exercise its shelter capabilities as part of the Radiological Emergency Preparedness program.

*Henrico*

No jurisdiction-specific information was available for Henrico County.

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### *Powhatan*

Powhatan County receives electricity from two power companies. Dominion Power supplies the majority of the homes and infrastructure for Powhatan; a loss of service from Dominion has a dramatic effect on the county. Southside Electric covers most of western Powhatan, but their customers are majority residential with only a minor impact on the key infrastructure. Recent improvements in Southside's system have improved their service during inclement weather.

### *City of Richmond*

No jurisdiction-specific information was available for the City of Richmond.

## **Estimating Losses**

HAZUS-MH was used to develop a loss estimate for the Richmond region. HAZUS-MH uses historical hurricane tracks and computer modeling to identify the probable tracks of a range of hurricane events. The impacts of these various events are combined to create a total annualized loss or the expected value of loss in any given year. The model addresses wind pressure, windborne debris, surge and waves, atmospheric pressure change, duration/fatigue, and rain from the perspective of hurricanes. Therefore, the results should be interpreted accordingly.

Uncertainties are inherent in any loss estimation methodology. They arise in part from incomplete scientific knowledge concerning hurricanes and their effects upon buildings and facilities. They also result from the approximations and simplifications that are necessary for comprehensive analyses. Incomplete or inaccurate inventories of the built environment, demographics and economic parameters add to the uncertainty. The data used in the Richmond region analysis was based on the nationwide database provided by HAZUS-MH. The loss estimate provided should be viewed as a broad approximation of the actual losses. In particular, losses are not calculated for individual buildings, but instead are based on the performances of entire classifications of buildings.

The loss estimate captures the cost of repair and replacement of damaged or destroyed buildings. In addition, the estimate includes the costs of damage to building contents including building inventory (i.e., contents related to business activities). Other economic losses included are:

- Relocation expenses for businesses and institutions
- Capital-related income losses (i.e., a measure of the loss of productivity, services or sales)
- Wage losses (consistent with income loss)

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- Rental income losses to building owners

A probabilistic scenario was used in conjunction with the default building inventory and default analysis parameters. Total annualized losses, or the expected value of loss in any one year, are presented in Table V-16 by jurisdiction. On a tract-by-tract basis, the losses are fairly consistent throughout the study area. Figure V-33 shows the annualized losses by Census tract. As the graphic shows, losses are somewhat higher in the eastern portion of the planning area. It should be noted that to approximate the losses for the Town of Ashland, two census tracts (i.e., 51085320601 and 51085320602) that cover the majority of the town were used. Also, the estimated losses for Hanover County include those for tracts that are part of the Town of Ashland.

**Table V-16 – Estimated Annualized Losses from Wind by Jurisdiction (per \$1000)**

Jurisdiction	Property Damage (Capital Stocks) Loss				Business Interruption (Income) Loss				Total Loss
	Building Damage	Contents Damage	Inventory Loss	Loss Ratio	Relocation Loss	Capitol Related Loss	Wages Loss	Rental Income Loss	
<i>Charles City</i>	186.1	70.6	0.1	5%	19.0	0.2	0.4	5.5	281.8
<i>Goochland</i>	143.2	35.4	0.1	1%	10.4	0.3	0.3	3.1	192.9
<i>Hanover</i>	1,207.1	296.0	3.7	2%	113.0	3.9	5.8	36.4	1,666.1
<i>Town of Ashland</i>	1,072.0	34.0	2.0	.01%	54.0	0	22.0	0	1,184.0
<i>Henrico</i>	4,150.1	1,115.2	11.3	2%	395.7	19.5	24.3	151.4	5,867.5
<i>New Kent</i>	333.8	111.8	0.4	4%	34.0	0.7	0.9	10.2	492.0
<i>Powhatan</i>	156.1	34.8	0.1	1%	11.9	0.2	0.2	3.6	206.8
<i>Richmond</i>	3,590.7	955.7	9.4	3%	377.1	31.3	41.0	177.7	5,182.8
<i>Total</i>	9,767.2	2,619.5	25.1	2%	961.1	55.9	73.0	388.0	13,889.7
<i>Source: HAZUS-MH analysis for Richmond region</i>									

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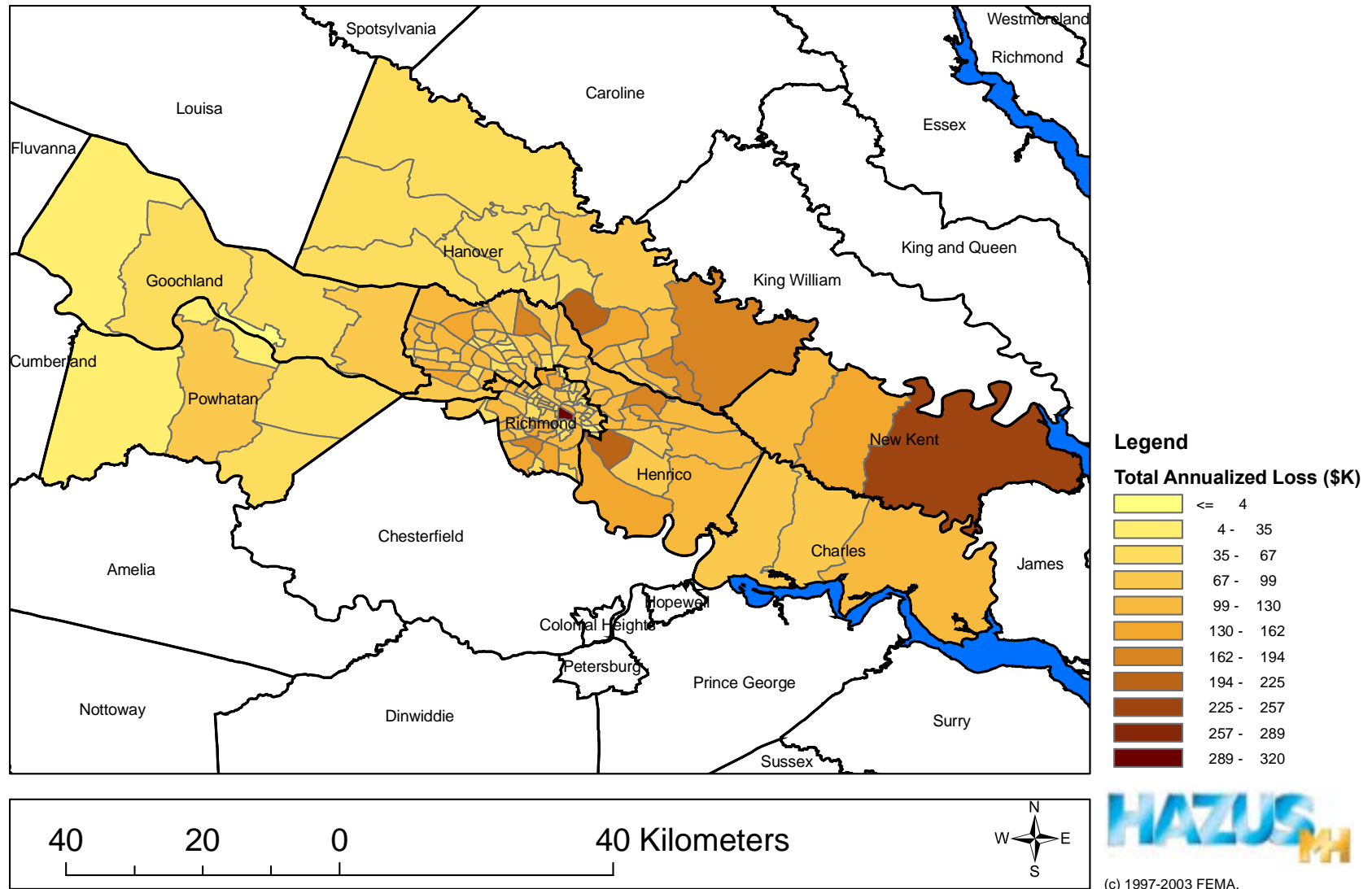


Figure V-33 – Total Annualized Hurricane Loss in the Richmond Region



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The loss estimate provided by HAZUS can be broken down by building type. Table V-17 presents the estimated annualized losses by jurisdiction. The majority of losses come from wood structures followed by masonry. Manufactured homes can be particularly vulnerable to the effects of a wind event. Charles City County had the highest percentage of manufactured home estimated losses (5% of total loss).

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**Table V-17 – Annualized Losses from Wind by Building Type by Jurisdiction (per \$1000)**

Jurisdiction	Wood (\$)	% of total	Masonry (\$)	% of total	Concrete (\$)	% of total	Steel (\$)	% of total	Manufactured Homes (\$)	% of total
<i>Charles City</i>	204.5	72%	60.0	21%	0.5	0.2%	2.6	1%	15.0	5%
<i>Goochland County</i>	141.0	73%	44.6	23%	0.9	0.5%	3.9	2%	2.5	1%
<i>Hanover County</i>	1155.3	69%	415.4	25%	12.4	0.7%	75.2	5%	8.5	1%
<i>Town of Ashland</i>	45.6	52%	26.45	30%	2.38	3%	10.32	12%	3.39	4%
<i>Henrico County</i>	3960.1	67%	1576.6	27%	58.6	1.0%	268.7	5%	8.8	0.1%
<i>New Kent County</i>	362.6	74%	112.1	23%	1.7	0.3%	7.3	1%	8.6	2%
<i>Powhatan County</i>	152.5	74%	48.8	24%	0.9	0.5%	3.1	1%	1.4	1%
<i>City of Richmond</i>	3166.0	61%	1550.6	30%	95.6	2%	360.0	7%	13.7	0.3%
<i>Total</i>	9141.9	66%	3808.0	27%	170.5	1%	720.8	5%	58.3	0.4%

*Source: HAZUS-MH analysis for Richmond region*

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HAZUS also provides estimates on the losses expected based on occupancy type. Table V-18 breaks out these expected annualized losses by jurisdiction. As can be seen in the table, the majority of losses (90%) come from residential structures followed by commercial (8%).

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**Table V-18: Annualized Losses from Wind by Occupancy Type by Jurisdiction (per \$1000)**

<b>Jurisdiction</b>	<b>Residential (\$)</b>	<b>% of total</b>	<b>Commercial (\$)</b>	<b>% of total</b>	<b>Industrial (\$)</b>	<b>% of total</b>	<b>Agriculture (\$)</b>	<b>% of total</b>	<b>Religion/ Non- Profit (\$)</b>	<b>% of total</b>	<b>Government (\$)</b>	<b>% of total</b>	<b>Education (\$)</b>	<b>% of total</b>
<i>Charles City County</i>	276	99%	2	1%	0	0%	0	0%	0	0%	1	0.4%	1	0.4%
<i>Goochland County</i>	187	98%	4	2%	0	0%	0	0%	0	0%	0	0%	0	0%
<i>Hanover County</i>	1,515	91%	111	7%	29	2%	2	0%	3	0.2%	0	0%	0	0%
<i>Town of Ashland</i>	69	78%	12	13%	8	9%	0	0%	0	0%	0	0%	0	0%
<i>Henrico County</i>	5,333	91%	391	7%	121	2%	0	0%	7	0.1%	4	0.1%	2	0.03%
<i>New Kent County</i>	475	97%	10	2%	4	1%	1	0.2%	1	0%	0	0%	0	0%
<i>Powhatan County</i>	201	98%	3	1%	1	0.5%	0	0%	0	0%	0	0%	0	0%
<i>City of Richmond</i>	4,453	86%	531	10%	104	2%	2	0%	15	0.3%	46	1%	20	0.4%
<i>Total</i>	12,440	90%	1,052	8%	259	2%	5	0.04%	26	0.2%	51	0.4%	23	0.4%

*Source: HAZUS-MH analysis for Richmond region*

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**Other Impacts**

Table V-19 shows the potential shelter needs for two probable events. As can be seen, shelter needs according to the model would be expected to be fairly small for a 100-year event (e.g., event with 1% chance of occurring in a given year) but increase dramatically for a 1,000-year event (e.g., event with .1% chance of occurring in a given year).

<b>Table V-20 – Potential Shelter Needs</b>				
<b>Jurisdictions</b>	<b>Displaced Households – 100-year event</b>	<b>Short Term Shelter Needs – 100-year event</b>	<b>Displaced Households – 1000-year event</b>	<b>Short Term Shelter Needs – 1000-year event</b>
<i>Charles City</i>	0	0	80	20
<i>Goochland</i>	0	0	1	0
<i>Hanover</i>	0	0	198	41
<i>Town of Ashland</i>	0	0	0	0
<i>Henrico</i>	7	1	1,504	392
<i>New Kent</i>	1	0	106	23
<i>Powhatan</i>	0	0	15	3
<i>Richmond</i>	15	3	3,274	1,074
<i>Source: HAZUS-MH analysis for Richmond region</i>				

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Table V-21 provides the estimated quantities of debris that may be generated by a 100-year event. Trees account for the majority of the debris that could be expected to occur.

Table V-21 – Potential Debris Quantities for 100-year Event			
Jurisdiction	Brick/ Wood (1 tons)	Concrete/Steel (1 tons)	Trees (1 tons)
<i>Charles City</i>	548	1	687,608
<i>Goochland</i>	123	0	471,265
<i>Hanover</i>	3,220	0	1,667,309
<i>Town of Ashland</i>	202	-	32,750
<i>Henrico</i>	11,138	1	789,567
<i>New Kent</i>	848	2	788,973
<i>Powhatan</i>	144	0	538,026
<i>Richmond</i>	11,596	0	131,137
<i>Total</i>	27,617	4	5,073,885
<i>Source: HAZUS-MH analysis for Richmond region</i>			

### Critical Facilities

The vulnerability of critical facilities such as police and fire stations, hospitals, shelters, and utility services varies greatly depending on the factors described in the previous sections. In order to accurately assess the relative vulnerability of these structures, data regarding the vulnerability factors is required. Generalizations based on the vulnerability factors can be made in certain instances. Due to the high level of importance to the community, the ability of these structures to resist the forces of high wind events greatly affects the community's overall vulnerability to these hazards.

HAZUS-MH was used to develop a loss estimate for critical facilities. The critical facilities inventory in HAZUS-MH, collected from national, public databases is known to be incomplete and potentially inaccurate. The following results should be understood to be a rough approximation of potential losses.

Unlike the loss estimates provided in the previous section, HAZUS-MH does not provide annualized dollar losses for critical facilities. Instead, it provides potential loss of use in terms of days the facility will not be able to function for seven return periods: 10-year, 20-year, 50-year, 100-year, 200-year, 500-year, and 1,000-year. Table V-22 presents the estimated loss of function for these return periods by facility type. The table also includes an estimated annualized loss of function or the expected total loss in any given year for all facilities of that type. For example, for a 100-year event, it is expected that one day of

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function will be lost for medical facilities. This could mean one medical facility is out of use for one day or it could mean two medical facilities are out of use for a half of a day each.

Table V-22 – Critical Facilities Loss of Days of Use by Return Period									
Type of Facility	Total Number of Facilities	10-Year	20-Year	50-Year	100-Year	200-Year	500-Year	1000-Year	Annualized Days Lost
Medical	15	0	0	0	1	35	178	406	0.6
Fire	29	0	1	0	40	49	259	679	1.4
Police	18	0	0	0	6	21	192	476	0.7
EOC	1	0	0	0	0	3	8	15	0.1
Schools	206	0	0	3	171	372	1,856	4,367	11.8

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## **Severe Winter Storms**

Severe winter storms and blizzards are extra-tropical cyclones that originate as mid-latitude depressions.<sup>37</sup> Snowstorms, blizzards, and ice storms are the most common examples. These storms can bring heavy snowfall, high winds, ice, and extreme cold with them. Historically, winter storms in southwestern Virginia have produced significant snowfall, sleet, and freezing rain.

## **Hazard History**

### 1940's

The January 1940 storm set records for Richmond, where official records began in 1897. The storm dropped almost two feet of snow (21.6 inches) in 24 hours and helped set a record for the month of 28.5 inches. Richmond was shut down with drifts as deep as four feet. Businesses were closed for a couple of days and some schools for a week.<sup>38</sup>

Three years after Richmond's big snowfall, in 1943, Richmond was hit with its worst ice storm of record up to that time. The ice accumulated to a glaze an inch thick. The weight of the ice was too much for utility poles and wires bringing them down and cutting off electricity and telephone service. Thousands of trees were damaged or destroyed by the weight of the ice.<sup>39</sup>

### 1960's

The Ash Wednesday storm of March 1962 was the biggest storm in a decade and it devastated western portions of the Commonwealth. Unlike most big winter storms that move up the coast, this storm took a more inland track across Richmond and the Chesapeake Bay. It brought rain and some high winds to Southeast Virginia and heavy snow and blizzard conditions over portions of the north and west.<sup>40</sup>

### 1970's

"The Presidents Day Storm" over February 18 and 19, 1979, was considered at the time the worst storm in 57 years to strike Northern Virginia. Snow depths from the storm ranged from 6 to 8 inches southwest and southeast, 8 to 14 inches in the piedmont from south-central Virginia through central Virginia (Richmond reported 11 inches), and up to 20 inches

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<sup>37</sup> FEMA. *Multi-Hazard Identification and Risk Assessment*. Washington, D.C., 1997.

<sup>38</sup> Watson, Barbara McNaught. *Virginia Winters: Snow, Wind, Ice and Cold*. Retrieved from <http://www.vdem.state.va.us/library/vawinter/va-win.htm>.

<sup>39</sup> *Virginia Winters*.

<sup>40</sup> *Virginia Winters*.



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over Northern Virginia. At times, snow was falling 2 to 3 inches per hour and temperatures were in the single digits to teens.<sup>41</sup>

### 1980's

The impacts of the "Blizzard of '83" exceeded those of the Presidents Day Storm of 1979. The early February storm covered an unusually large area of Virginia with more than a foot of snow. Richmond received 16.8 inches over a 24-hour period and received a total of 18 inches. Winds gusted over 25 miles per hour all day on February 11, in the Richmond area causing three foot high drifts. This was the third heaviest snowfall on record for Richmond for the last 100 years. The cost of clearing the snow from state roads came to \$9 million.<sup>42</sup>

### 1990's

One of the most significant winter storms to affect the Richmond region was the "Super Storm of March '93", also known as "The Storm of the Century". Occurring between March 12 and 15, 1993, this storm affected 26 states throughout the central and eastern portions of the United States. The storm resulted in a federal disaster declaration for central Virginia. Throughout the region, the snowfall amounts ranged from 12 inches to over 48 inches depending on elevation. Virginia called out its National Guard to help with emergency transports and critical snow removal.<sup>43</sup>

During the February 10 and 11, 1994 ice storm, some areas of southern Virginia received a devastating 3 inches of ice, causing tremendous tree damage and power outages for up to a week.

The "Blizzard of '96" or the "Great Furlough Storm" began late on Saturday, January 6. Around Richmond and throughout central Virginia 1 to 2 feet of snow fell with 11 to 14 inches in the immediate metro area. The entire I-95 corridor from near the North Carolina border into New England was paralyzed.<sup>44</sup>

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<sup>41</sup> *Virginia Winters.*

<sup>42</sup> *Virginia Winters.*

<sup>43</sup> *Virginia Winters.*

<sup>44</sup> *Virginia Winters.*

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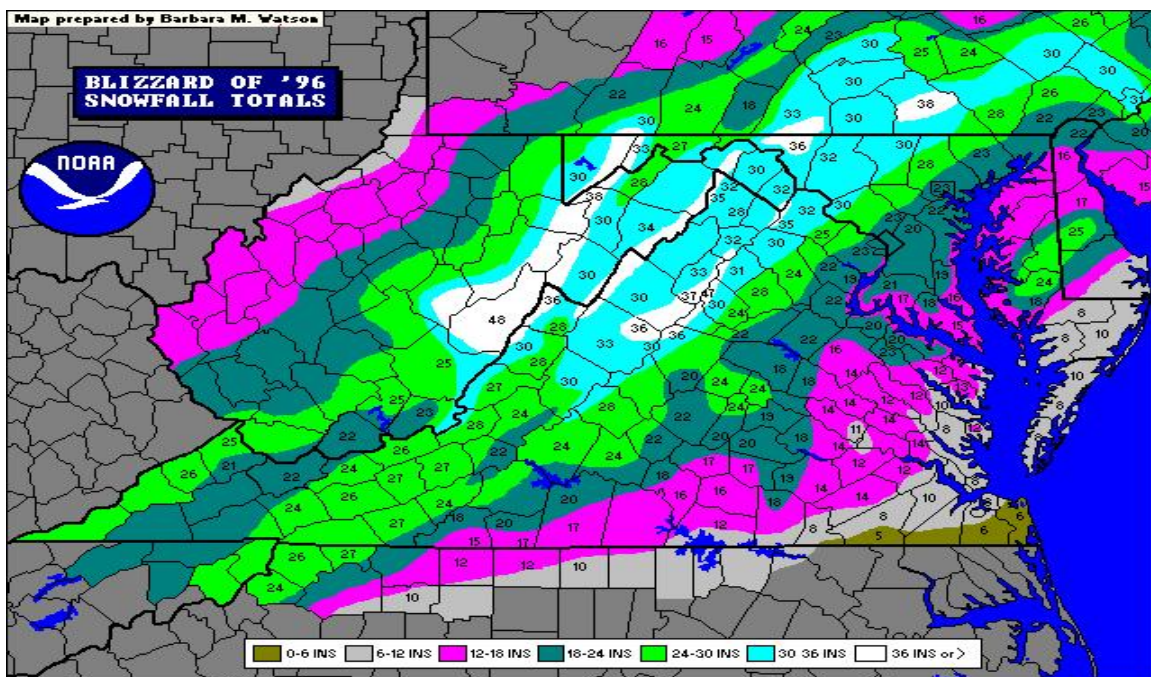


Figure V-34 — Snowfall Totals from 1996 Blizzard

On February 16, 1996, another nor'easter moved up the coast dumping 6 to 12 inches of snow in a swath across Virginia from Nottoway to Fredericksburg with Charlottesville on the west side of the heavy band and Richmond on the east side.<sup>45</sup>

### 2000's

On January 25, 2000, a significant winter storm dumped over one foot of snow across much of central and eastern Virginia, with isolated amounts of up to 19 inches reported. There was also significant blowing and drifting of snow as winds gusted over 30 mph during the storm. A very cold air mass built into the region after the storm, preserving the snowpack for over a week in many areas. County totals in the planning area ranged from 9 to 15 inches. The Richmond International Airport was closed during this storm. Schools were closed. Non-essential federal, state and county government offices were closed or quickly closed once the full impact of the storm was realized.<sup>46</sup>

A winter storm produced 5 to 8 inches of snow across the piedmont of central Virginia on January 2, 2002. The City of Richmond experienced 7-8 inches of snow while Hanover County received 8 inches. Local law enforcement agencies reported numerous accidents.

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<sup>45</sup> *Virginia Winters.*

<sup>46</sup> *U.S. Storm Event Database. Virginia Winters.*

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Most, if not all schools in the area, were closed Thursday, January 3, and Friday, January 4, due to very slippery road conditions.<sup>47</sup>

Table V-23 includes ranges of snowfall for select historic events in the Richmond region. This table is not inclusive of all historic snowfall events. Appendix D provides a complete list of recorded major events.

Table V-23 — Historic Snow Fall Amounts	
Date	Amount
January 23-24, 1940	21.6 inches
January 22-28, 1943	1 inch (ice)
March 1, 1962	12-18 inches
January 19-20, 1978	4-8 inches
February 18-19, 1979	11 inches
February 10-11, 1983	18 inches
March 13-14, 1993*	12 inches
February 1, 1994*	1-3 inches (ice)
January 6-13, 1996*	11 to 14 inches (12-24 in metro area)
February 16, 1996	6 to 12 inches
January 25, 2000*	9 to 15 inches
January 2, 2002	5 to 8 inches
* Presidential declaration given for at least one jurisdiction in planning area	

## **Hazard Profile**

Although the Commonwealth of Virginia is not generally associated with severe winter storms, the central part of the state can experience them annually. These storms can produce between 4 and 12 inches of snow from each event as well as bring ice or other winter precipitation. In addition, the Richmond region often experiences winter weather in the form of ice storms.

Total average annual snowfall within the study area varies slightly from jurisdiction to jurisdiction (Figure V-35). The City of Richmond, and Hanover and Henrico counties have an average annual snowfall of 14.4" per year while Charles City County's annual average

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<sup>47</sup> U.S. Storm Event Database

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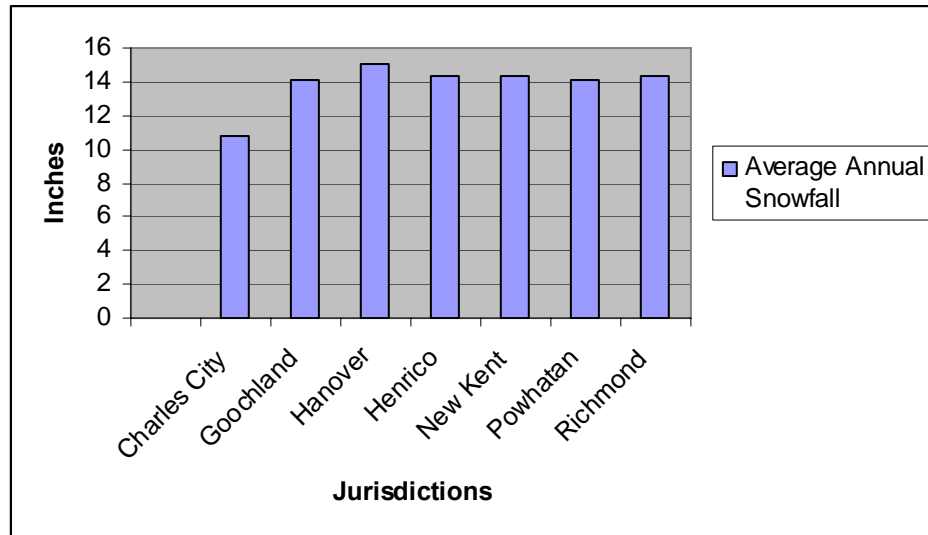
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snowfall is 10.8 inches. However, as Table V-15 illustrates, storms producing higher snowfall amounts are possible.



**Figure V-35 — Average Annual Snowfalls**

*(Source: Virginia Economic Development Partnership Profiles)*

In addition to snow, winter storms also can bring sleet and freezing rain to the area. Ice storms are an important part of the risk posed to the Richmond region. Heavy accumulations of ice can bring down trees and topple utility poles and communication towers. Ice can disrupt communications and power for days while utility companies repair extensive damage. Even small accumulations of ice can be severely dangerous to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces.

Ice forms in different ways:

- **Sleet** is rain that freezes into ice pellets before it reaches the ground. Sleet usually bounces when hitting a surface and does not stick to objects; however, it can accumulate like snow and cause roads and walkways to become hazardous.
- **Freezing rain** (also known as an ice storm) is rain that falls onto a surface that has a temperature below freezing. The cold surface causes the rain to freeze so the surfaces—trees, utility wires, vehicles, and roads—become glazed with ice. Even small accumulations of ice can cause significant hazards to people—especially pedestrians and motorists—and property.<sup>48</sup>

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<sup>48</sup> *Talking About Disaster.*

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In its most severe form, freezing rain can fall as part of an ice storm that can coat the area with a layer of ice up to 3” thick. Ice storms can cause significant damage by snapping tree limbs and bending trees to the ground. These fallen limbs and trees can completely block roadways, cut access to certain areas of the Planning District for days, and interfere with and destroy overhead utility lines.

### **Predictability and Frequency**

The National Weather Service tracks winter storms by radar. Based on this radar information as well as models, the National Weather Service provides up-to-date weather information and issues winter storm watches to indicate when conditions are favorable for a winter storm, and winter storm warnings if a storm is actually occurring or detected by radar. On average, the Richmond region may experience one severe winter storm in a given year. Snowfalls amounts for these storms can vary from a few inches to up to a foot of snow in extreme cases.

### **Primary Impacts**

Winter storms can disrupt lives for periods of a few hours or up to several days, depending upon the severity of the storm. Transportation systems are usually among the first and hardest hit sectors of a community. Snow and ice can block primary and secondary roads, and treacherous conditions make driving difficult; some motorists may be stranded during a storm, and emergency vehicles may not be able to access all areas. Many of the roads in the planning area are maintained by the State of Virginia, which is responsible for snow and debris removal. Henrico County and the City of Richmond, however, maintain their own roads. Of special note, is that Colony Trail Road, State Route 110, is the only access to a major subdivision in New Kent County. This steep road can be treacherous in winter weather conditions.

Utility infrastructure also can be adversely affected by winter storms. Heavy snow and ice can cause power lines to snap, leaving citizens without power and, in some cases, heat for hours or even days. Likewise, telephone lines also can snap, disabling communication within portions of a community. Frozen water pipes can rupture in people’s homes, and water and sewer mains can freeze and leak or rupture if not properly maintained. These ruptures can lead to flooding and property damage.

People’s health also can be adversely affected by severe winter weather. People who lose heat in their homes and do not seek alternate shelter, people who get stuck in snowdrifts while driving, or people working and playing outdoors can suffer from hypothermia and frostbite. Since winter weather hazards generally affect the entire study area and vary in intensity and form, it is not possible to quantify primary effects or specific damages.

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In the Richmond region, winter storms typically cause damage to trees, which then cause damage to power lines causing outages. The debris created by the trees also blocks roads. Clean-up of the debris is often complicated because responsibility is shared by the Virginia Department of Transportation and private utility companies (i.e., Dominion Virginia Power, Southside Electric Cooperative). The impact on power lines was described previously in the Wind section.

### **Secondary Effects**

Secondary effects of winter storms are broad. Treacherous driving conditions can result in automobile accidents in which passengers may be injured and property damages may occur. Deliveries of heating fuel can be delayed by impassible roads. Impassable roads also can result in schools being closed because buses are not able to access their routes and bring children to school. The costs of salting and sanding roads and of snow removal can be significant to communities both large and small. The costs to repair roads after spring thaws also can be significant.

The local economy also can suffer if businesses close due to inclement winter weather. The impact could be significant in a larger event. In addition, disabled transportation systems may mean that shipments of goods and services are delayed, which may result in decreased inventory for retailers and increased inventory for industrial and commercial suppliers.

### ***Drought***

“Drought is a condition of moisture deficit sufficient to have an adverse effect on vegetation, animals, and man over a sizeable area” (USGS, 2000). Three significant types of drought can affect the study area, which are meteorological, agricultural, or hydrologic drought. Meteorological drought is simply a departure from a normal precipitation amount, and is reliant on no other factors. Agricultural drought describes a soil moisture deficiency to the extent it effects the needs of plant life, primarily crops. Hydrologic drought is defined in terms of shortfall of water levels of lakes and reservoirs, and stream flow in rivers, streams, and soils (Multi Hazard Risk Assessment, 2000). Drought is a natural part of most climatic areas, but the severity of droughts differs based on duration, geographic extent, and intensity.

### **Hazard History**

There have been a number of significant droughts recorded in Virginia since 1900. The most recent drought extended over a period of four years, from 1998 to 2002. This period saw rainfall levels well below normal and caused many communities throughout the state to institute water restrictions. Figure V-36 illustrates statewide precipitation, or lack of it between 1895 and 2002.

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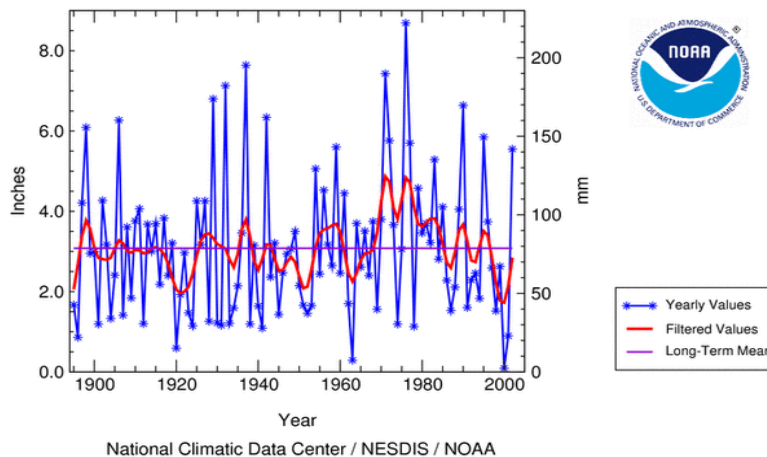
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Although meteorologists have attempted to predict long term changes and trends in weather patterns, the onset of a significant drought cannot be predicted. Extended periods of dry weather have occurred many times over the past 100 years.



**Figure V-36 — Virginia Statewide Precipitation, October 1895-2002**

### **Hazard Profile**

Just as there are multiple types of drought, there are multiple methods to indicate when a drought is occurring, as well as the severity of the drought. The multiple indices are based on a variety of data including precipitation amounts, stream flows, soil moisture, snow pack, as well as other water storage data. Commonly, the drought indices used depends on the type of drought being measured. It is important to note that not all types of drought must be occurring simultaneously. In some cases an area can be affected by one form of drought, while levels measuring another form of drought are normal.

### **Vulnerability Analysis**

If a significant drought event were to occur, it could bring economic, social, and environmental impacts to the study area. Commonly one of the most significant economic effects to a community is the agricultural impacts. Other economic effects could be felt by businesses that rely on adequate water levels for their day to day business such as carwashes and laundromats.

Drought also can create conditions that promote the occurrence of other natural hazards such as wildfires and wind erosion. The likelihood of flash flooding is increased if a period of severe drought is followed by a period of extreme precipitation. Low-flow conditions also decrease the quantity and pressure of water available to firefighters to fight fires, while the dry conditions increase the likelihood fires will occur.

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Environmental drought impacts include those on both human and animal habitats and hydrologic units. During periods of drought, the amount of available water decreases in lakes, streams, aquifers, soil, wetlands, springs, and other surface and subsurface water sources. This decrease in water availability can affect water quality such as oxygen levels, bacteria, turbidity, and temperature increase and pH changes. Changes in any of these levels can have a significant effect on the aquatic habitat of numerous plants and animals found throughout the study area.

Low water flow can result in decreased sewage flows and subsequent increases in contaminants in the water supply. Decrease in the availability of water also decreases drinking water supply and the food supply as food sources become scarcer. This disruption can work its way up the food chain within a habitat. Loss of biodiversity and increases in mortality can lead to increases in disease and endangered species.

Table V-24 provides an overview of the agricultural products that could be affected by a drought. These numbers are based on the 2002 Census of Agriculture conducted by the U.S. Department of Agriculture. The numbers show all of the counties have significant agricultural sectors that could be impacted by drought. Hanover, in particular, had almost \$32 million in products sold, most of which in crops.

Table V-24 – Agricultural Exposure				
Jurisdiction	Land in farms - 2002 acreage (change from 1997)	Market Value of Agricultural Products Sold (\$1,000)		
		Total value of agricultural products sold (\$)	Value of crops including nursery and greenhouse (\$)	Value of livestock, poultry, and their products (\$)
<i>Charles City County</i>	28,676 (N/A)	6,278	4,925	1,353
<i>Goochland County</i>	52,335 (+.004%)	5,750	1,485	4,265
<i>Hanover County</i>	100,537 (-3%)	31,799	24,935	6,864
<i>Henrico County</i>	28,135 (-3%)	7,610	6,743	867
<i>New Kent County</i>	19,303 (+13%)	3,086	2,800	286
<i>Powhatan County</i>	54,644 (+12%)	8,101	1,567	6,534
<i>City of Richmond</i>	N/A	N/A	N/A	N/A
<i>Source: United States Department of Agriculture, Virginia Agricultural Statistics Service. 2002 Census of Agriculture. County Profiles.</i>				



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## ***Hail Storms***

Many strong thunderstorms produce hail. Large hail, and the glass it may break, can injure people and animals. Hail can be smaller than a pea, or as large as a softball, and can be very destructive to automobiles, glass surfaces (e.g., skylights and windows), roofs, plants, and crops.<sup>49</sup> The size of hailstones is a direct function of the severity and size of the storm. Hailstorms occur more frequently in the late spring and early summer and are more common in the Midwest. The land area affected by individual hailstorms is not much smaller than that of a parent thunderstorm, an average of 15 miles in diameter around the center of a storm.<sup>50</sup>

## **Hazard History**

Most of the hail incidents reported featured hail between .75 and 1 inch in diameter. There were a total of 74 hail incidents reported between 1960 and 2004 according to the NCDC database. This makes for a recurrence interval of .6 years or approximately every 5 months. Table V-25 shows the breakdown by jurisdiction. A full listing of the events can be found in Appendix D.

Table V-25 — Hail Incidents from 1960-2004	
Jurisdiction	Count
<i>Charles City County</i>	10
<i>Goochland County</i>	21
<i>Hanover County</i>	27
<i>Henrico County</i>	37
<i>New Kent County</i>	16
<i>Powhatan County</i>	20
<i>City of Richmond</i>	23
<i>Source: National Climatic Data Center</i>	

## ***Extreme Heat***

Extreme heat can be a forgotten natural hazard but it can be deadly. The Centers for Disease Control state that excessive heat exposure caused 8,015 deaths in the United States between

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<sup>49</sup> *Talking About Disaster.*

<sup>50</sup> *Multi-Hazard Identification and Risk Assessment.*

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1979 and 1999.<sup>51</sup> The Virginia Department of Health reports that between 1999 and 2004 there were three deaths from extreme heat in the Richmond region. All three deaths occurred in Hanover County.

The National Disaster Education Coalition, in *Talking About Disasters*, provides the following description of the extreme heat hazard:

“In recent years, excessive heat has caused more deaths than all other weather events, including floods. The American Meteorological Society reports that on average heat kills more than 1,000 people each year. A heat wave is a prolonged period of excessive heat, often combined with excessive humidity. Generally, excessive heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region during summer months, last for a prolonged period of time, and often are accompanied by high humidity.

Heat can kill by pushing the human body beyond its limits. Under normal conditions, the body's internal thermostat produces perspiration that evaporates and cools the body. However, in excessive heat and high humidity, evaporation is slowed and the body must work extra hard to maintain a normal temperature. Elderly people, young children, and those who are sick or overweight are more likely to become victims of excessive heat. Because men sweat more than women do, they become more quickly dehydrated and are more susceptible to heat illness.

The duration of excessive heat plays an important role in how people are affected by a heat wave. Studies have shown a significant rise in heat-related illnesses when excessive heat lasts more than two days.

People living in urban areas may be at greater risk from the effects of a prolonged heat wave than are people living in rural regions. An increased health problem, especially for those with respiratory difficulties, can occur when stagnant atmospheric conditions trap pollutants in urban areas, thus adding unhealthy air to excessively hot temperatures. In addition, asphalt and concrete store heat longer and gradually release heat, resulting in significantly higher temperatures, especially at night—an occurrence known as the "urban heat island effect."<sup>52</sup>

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<sup>51</sup> National Center for Environmental Health, Centers for Disease Control. *About Extreme Heat*. Retrieved from <http://www.cdc.gov/nceh/hsb/extremeheat/>

<sup>52</sup> *Talking About Disaster: Guide for Standard Messages*.

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Extreme heat also can cause water shortages and exacerbate fire hazards. Roads, bridges, and railroad tracks are susceptible to damage from extreme heat.<sup>53</sup> Demand for electricity can soar during periods of extreme heat, because the primary measure against extreme heat is the use of air conditioning. Brown-outs could result if electric supply can not meet demand.

### **Hazard History**

The National Climatic Data Center database only has one extreme heat event listed for the Richmond region since recordkeeping for extreme heat events began in 1993. At the beginning of May 1998, an early-season four-day heat wave produced record or near record high temperatures across central and eastern Virginia. High temperatures were in the 80s and low 90s across the region on May 18. Then, on May 19, May 20, and May 21, high temperatures were in the 90s throughout the area. May 20 was the hottest of the four days as readings climbed into the mid to upper 90s. Also, Norfolk International Airport set a record with 98 degrees and Farmville (co-op observer station) set a record with 96 degrees. Unfortunately though, the heat wave was responsible for numerous reports of heat exhaustion and forced many non-air conditioned schools to close or have early dismissals. Extreme heat events are also recorded in July 1987 and August 1995.<sup>54</sup>

According to a map developed for the *Multi-hazard Identification and Risk Assessment*, the study area has a 5% chance of exceeding 100-115 degrees Fahrenheit on the heat index in a given year. Virginia's humid subtropical climate contributes to the severity of the hazard.

### **Landslide**

The term "landslide" describes many types of downhill earth movements ranging from rapidly moving catastrophic rock avalanches and debris flows in mountainous regions to more slowly moving earth slides.<sup>55</sup>

### **Hazard History**

Representatives from the City of Richmond reported that a number of areas in the city were affected by landslides triggered by the rains of Tropical Storm Gaston in August 2004. Approximately ten locations experienced at least one slide.

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<sup>53</sup> *Multi-Hazard Identification and Risk Assessment*.

<sup>54</sup> SHELDS

<sup>55</sup> National Disaster Education Coalition. *Talking About Disaster: Guide for Standard Messages*. Washington, D.C., 2004.

## **Vulnerability Analysis**

The United States Geological Survey developed a national landslide incidence map in 1982. This national map was used as a basis for the maps in this analysis. The map shows areas where large numbers of landslides have been recorded (incidence) and areas that may be susceptible to landslides because of their geologic composition (susceptibility). According to the report that accompanies the incidence map, “susceptibility is not shown where it is comparable to incidence – for example, where areas of the highest category of incidence are assumed to have high susceptibility and where areas of the lowest category are assumed to have low susceptibility.”<sup>56</sup>

The report goes on to state,

“The map was prepared by evaluating formations or groups of formations shown on the geologic map of the United States and classifying them as having high, medium, or low landslide incidence (number of landslides) and being of high, medium, or low susceptibility to landsliding. Those map units or parts of units with more than 15 percent of their area involved in landsliding were classified as having high incidence; those with 1.5 to 15 percent of their area involved in landsliding, as having medium incidence; and those with less than 1.5 percent of their area involved, as having low incidence. This classification scheme was modified where particular lithofacies are known to have variable landslide incidence or susceptibility.”

The susceptibility categories are largely subjective because insufficient data was available for precise determinations. Because the map is highly generalized, was created at a national scale, and is based on relatively old and imprecise data, it should not be taken as an absolute guide to landslide incidence and susceptibility and should not be used for site selection purposes.

Figures V-37 through V-43 show the landslide incidence and susceptibility for the Richmond region. Most of the region has a low to moderate incidence and/or susceptibility to landslide though large portions of the City of Richmond and Henrico County appear to have moderate incidence and high susceptibility. As noted in the previous section, landslides have occurred in the City of Richmond following high rainfall but are generally are limited in scope and/or extent. The primary area of concern noted by city officials Government Road. At the time of this report, this is the best available data; no other historical data is available.

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<sup>56</sup> Radbruch-Hall, Dorothy H. et al. United States Geologic Survey. *Landslide Overview Map of the Conterminous United States*. U.S. Geological Survey Professional Paper 1183. 1982.

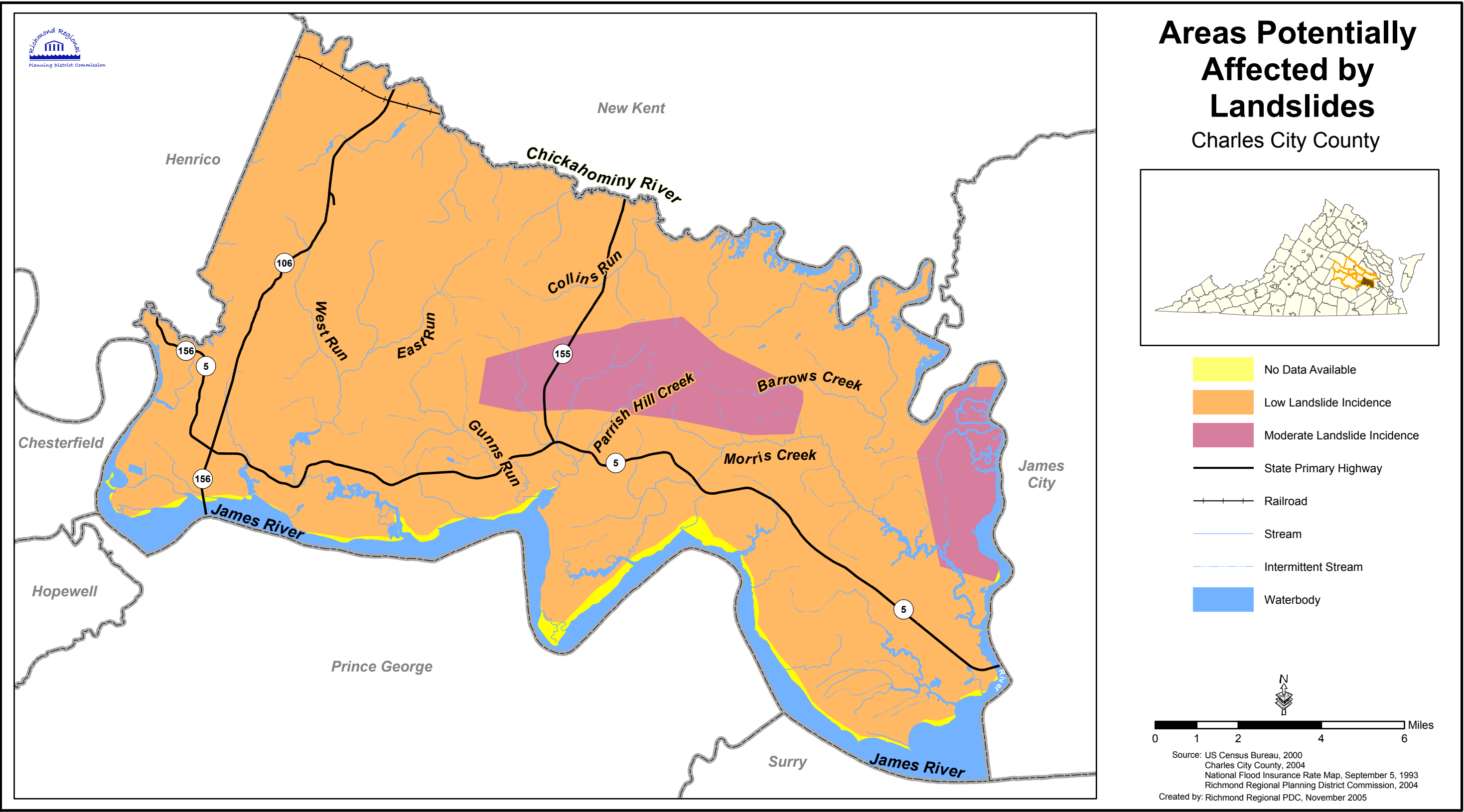


Figure V-37 - Charles City County Landslide Incidence and Susceptibility

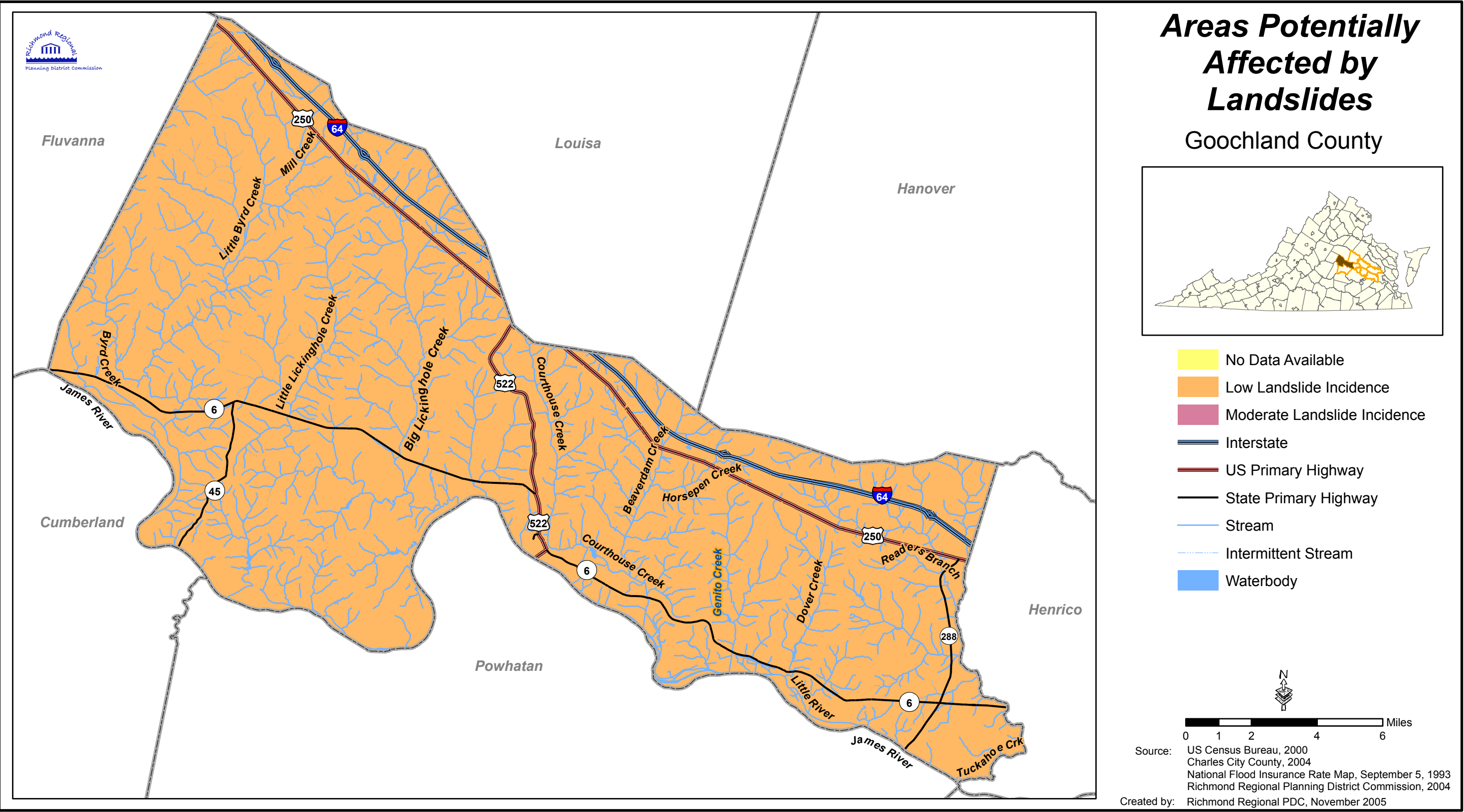


Figure V-38 - Goochland County Landslide Incidence and Susceptibility



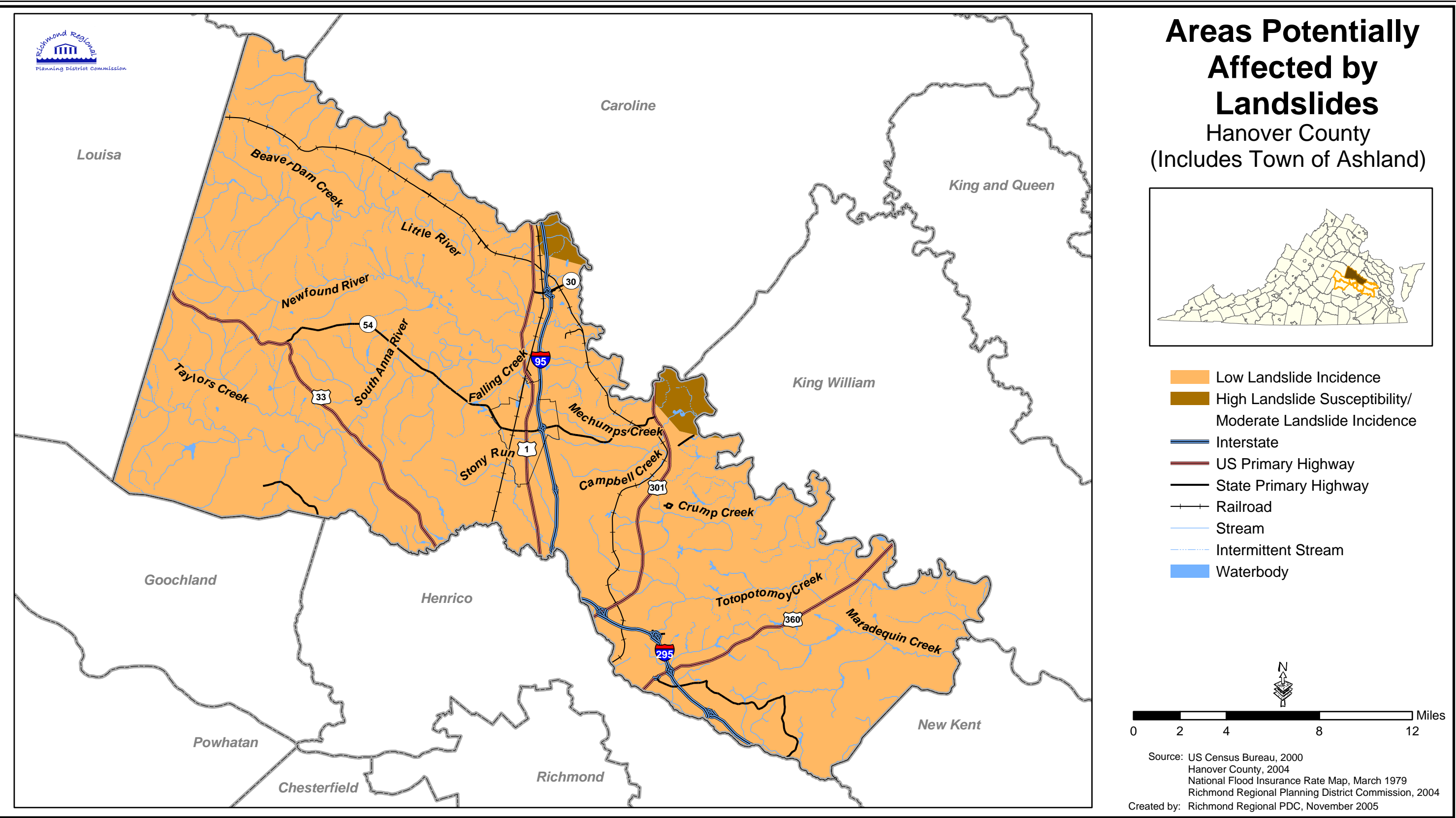


Figure V-39 - Hanover County and the Town of Ashland Landslide Incidence and Susceptibility

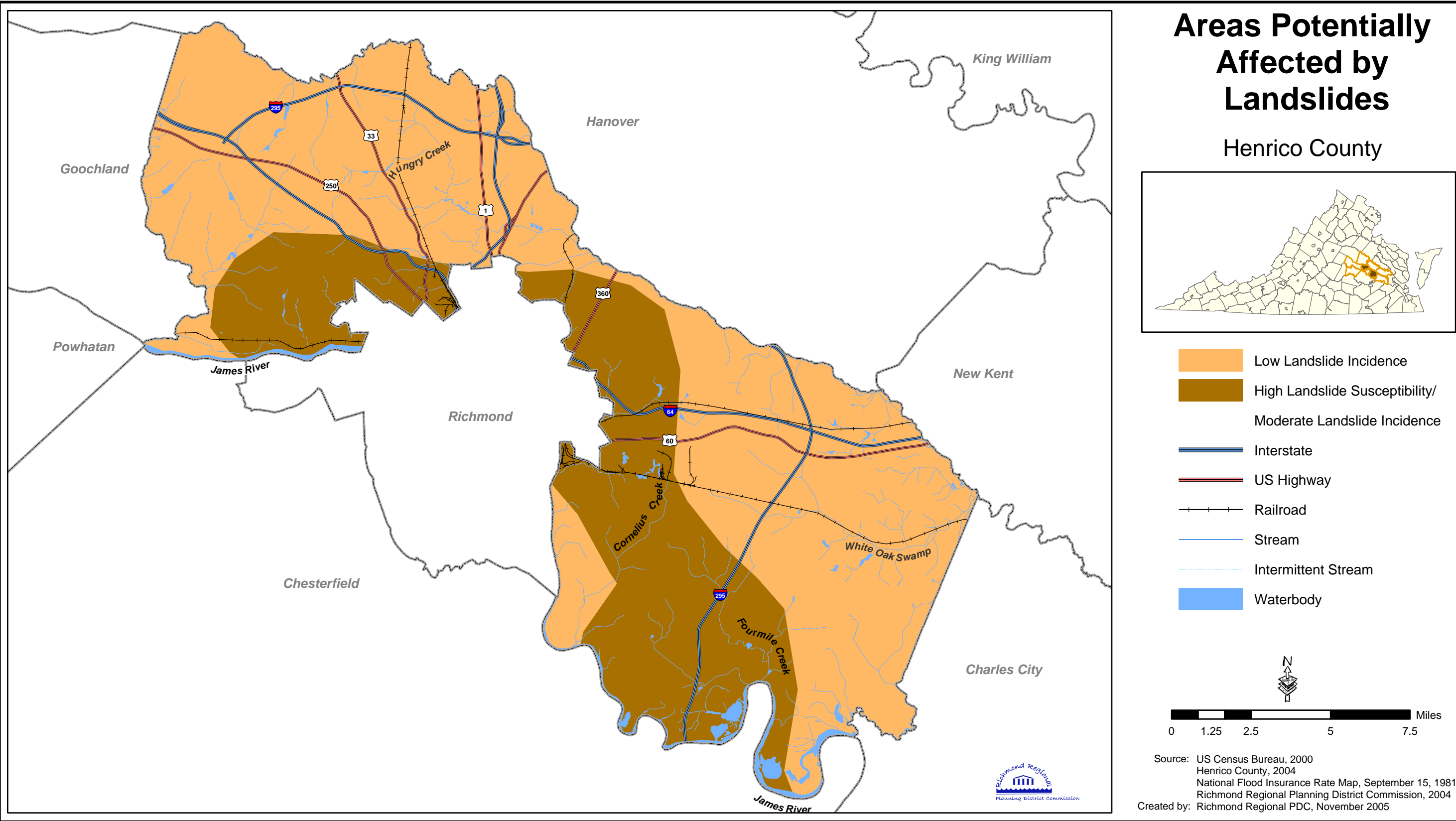


Figure V-40 - Henrico County Landslide Incidence and Susceptibility



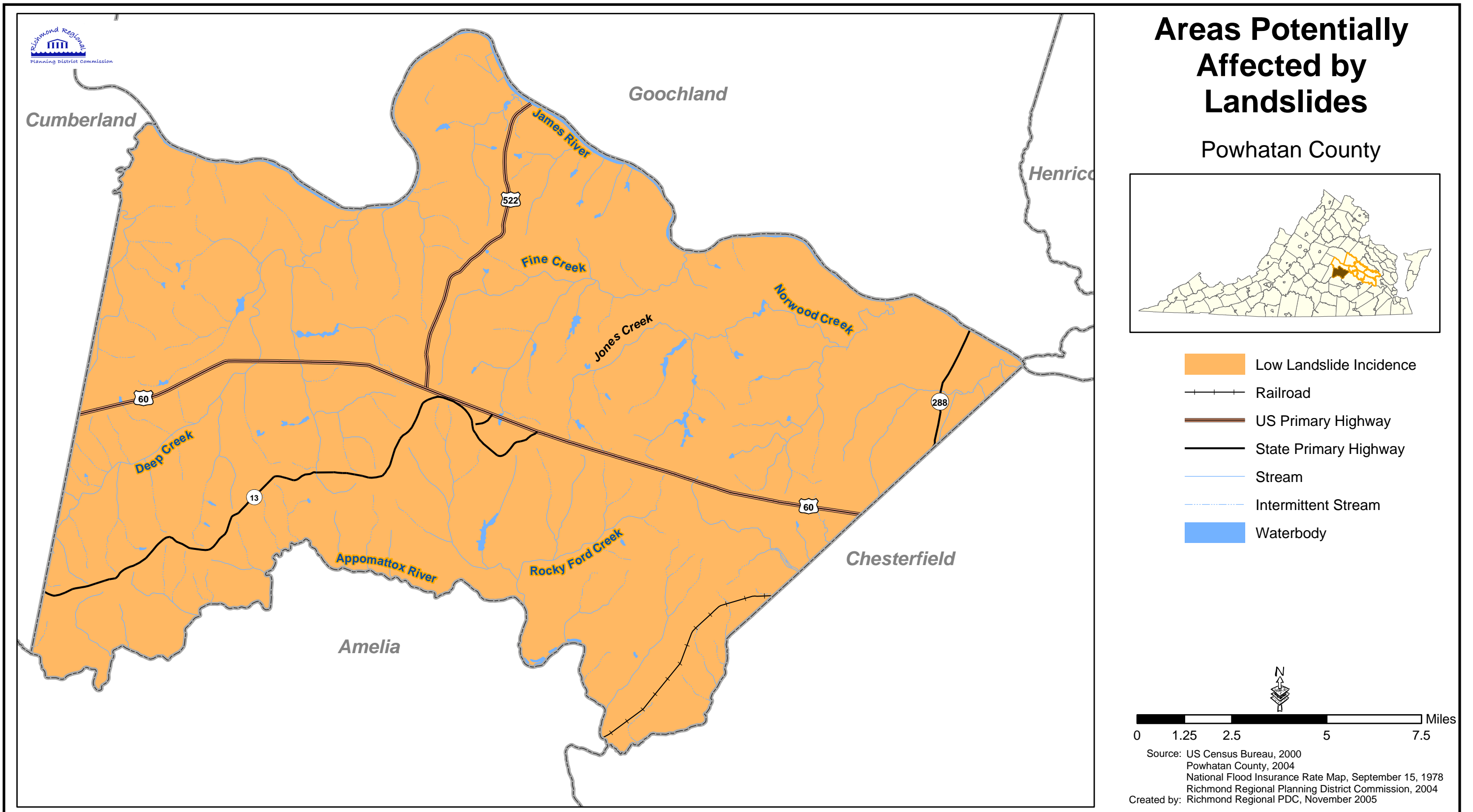


Figure V-41 - Powhatan County Landslide Incidence and Susceptibility

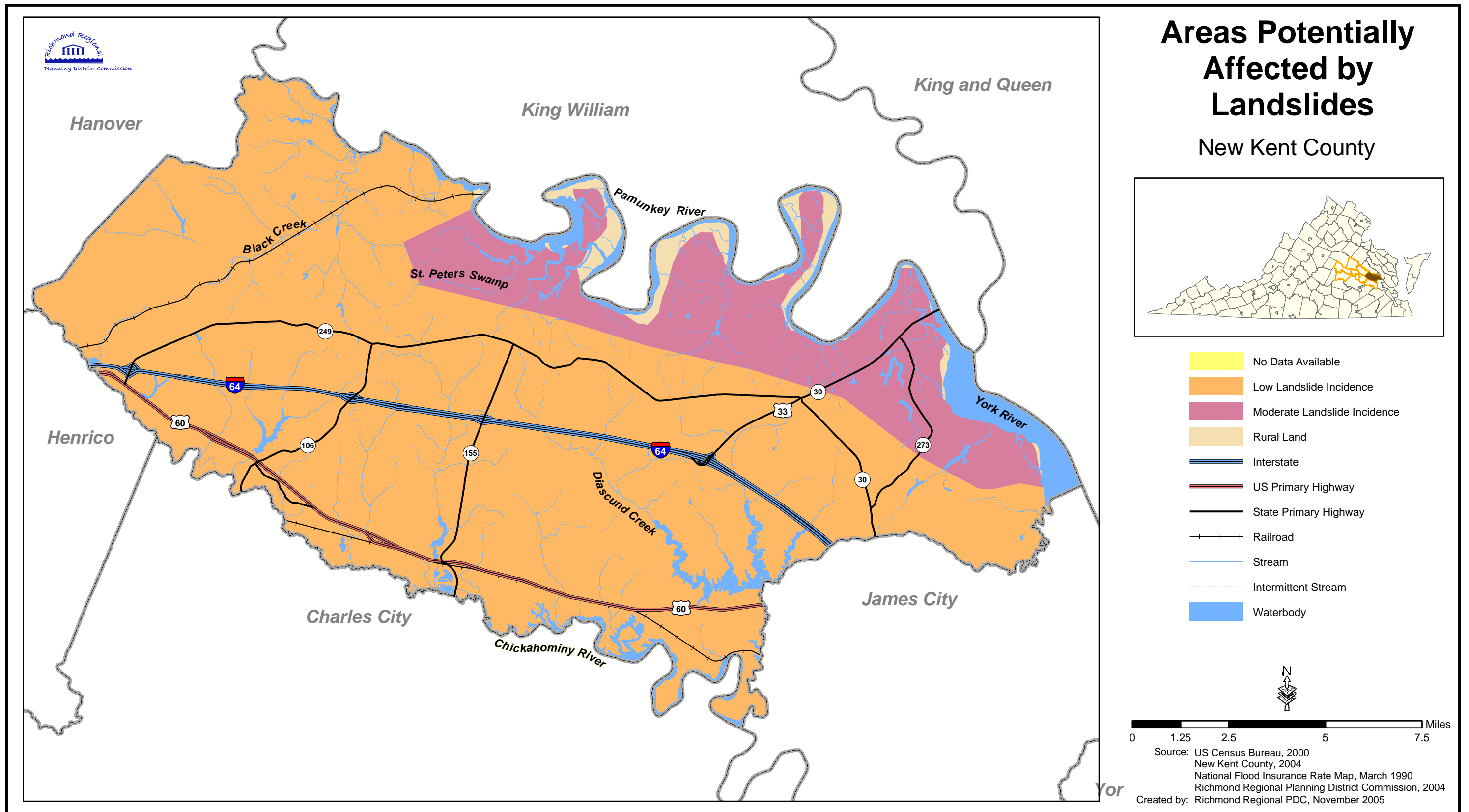


Figure V-42 - New Kent County Landslide Incidence and Susceptibility

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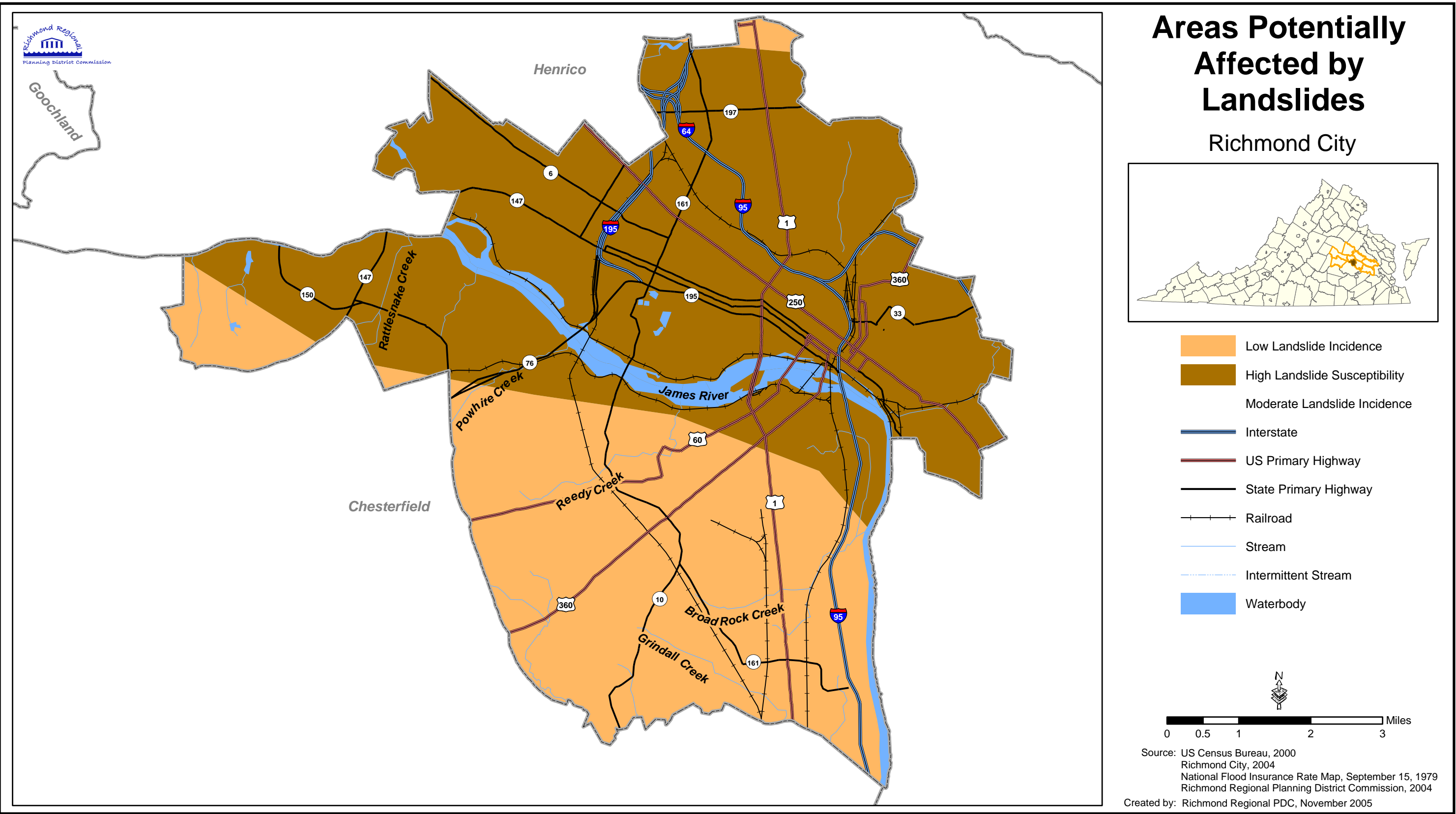


Figure V-43 - City of Richmond Landslide Incidence and Susceptibility

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## **Wildfire**

“A wildfire is an uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures” and may originate from a variety of ignition sources.<sup>57</sup> The risk of wildfires, though not as high as it is in the western United States, is a genuine concern for the Commonwealth of Virginia. Each year, about 1,600 wildfires consume a total of 8,000 to 10,000 acres of forest and grassland in the Commonwealth. During the fall drought of 2001, Virginia lost more than 13,000 acres to wildfires.<sup>58</sup>

In 2003, prior to the completion of this study, the Virginia Department of Forestry (VDOF) completed a statewide *Wildfire Risk Assessment (WRA)* in an attempt to quantify the varying levels of risk throughout the state. The data gathered in this risk assessment were grouped by the various Virginia Planning District Commissions (PDCs) for the years of 1995 through 2001. This assessment utilized GIS-based data for the Richmond region, regarding a number of wildfire related factors including hazard incidents, land cover, topography, and population density, among others. Based on this data, and utilizing a detailed risk assessment methodology, VDOF identified all areas as having a wildfire risk level of *High, Medium, Low, or None*. Because the data utilized in this statewide risk assessment is current, and the overall analysis is extremely comprehensive, the VDOF risk assessment served as the basis for this study.

## **Hazard History**

Most of Virginia’s wildfires were caused either intentionally or unintentionally by humans. Due to the growth of the population of the Commonwealth, there has been an increase in people living in the urban-wildland interface, as well as an increase in use of the forest for recreational purposes. Historical records of wildfire events specific to the study area are limited, and not all wildfires are reported. Based on the data obtained from the VDOF WRA, between 1995 and 2001 there have been over of 519 wildfire incidents in the Richmond region. The numbers of incidents, per county per year, are listed in Table V-26. As seen in the table, Goochland and Powhatan counties had the greatest number of incidents. The location of incidents can be seen on the county maps at the end of this section (Figure V-44 through V-50). As the maps show, many of the incidents occur in high risk areas.

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<sup>57</sup> FEMA. *Understanding Your Risks: Identifying Hazards and Estimating Losses*. FEMA 386-2. Washington, D.C., 2001.

<sup>58</sup> Virginia Department of Forestry. Retrieved from <http://www.dof.virginia.gov/fire/va-fire-history.shtml>

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**Table V-26 — Wildfire Incidents Per Year Per Jurisdiction**

<i>Year</i>	<i>Charles City County</i>	<i>Goochland County</i>	<i>Hanover County</i>	<i>Henrico County</i>	<i>New Kent County</i>	<i>Powhatan County</i>	<i>City of Richmond</i>	<i>Total</i>
1995	12	20	19	13	14	26	N/A	<b>104</b>
1996	2	15	5	4	8	17	N/A	<b>51</b>
1997	17	15	4	12	13	24	N/A	<b>85</b>
1998	8	15	11	3	5	14	N/A	<b>56</b>
1999	10	11	16	5	7	19	N/A	<b>68</b>
2000	7	8	8	8	4	6	N/A	<b>41</b>
2001	20	18	10	8	15	27	N/A	<b>98</b>
<b>Total</b>	<b>76</b>	<b>102</b>	<b>73</b>	<b>53</b>	<b>66</b>	<b>133</b>	N/A	<b>503</b>
<i>Source: Virginia Department of Forestry</i>								

The causes of the fires are found in Table V-27. Debris burning caused almost half of the wildfire incidents reported between 1995 and 2001. Children accounted for about ten percent of the incidents. No information was available for the City of Richmond.

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**Table V-27 — Wildfire Incidents by Cause Per County**

<i>Cause</i>	<i>Charles City County</i>	<i>Goochland County</i>	<i>Hanover County</i>	<i>Henrico County</i>	<i>New Kent County</i>	<i>Powhatan County</i>	<i>Total</i>
Unknown	0	0	0	2	0	14	<b>16 (3%)</b>
Lightning	5	1	0	2	1	0	<b>9 (2%)</b>
Campfire	1	1	1	1	0	0	<b>4 (1%)</b>
Smoking	9	7	12	1	6	3	<b>38 (8%)</b>
Debris Burning	38	61	28	13	31	73	<b>244 (49%)</b>
Incendiary	3	10	2	3	5	4	<b>27 (5%)</b>
Equipment Use	2	7	7	7	7	12	<b>42 (8%)</b>
Railroad	0	1	7	0	1	0	<b>9 (2%)</b>
Children	9	5	6	17	8	3	<b>48 (10%)</b>
Misc.	9	9	10	7	7	24	<b>66 (13%)</b>
<b>Total</b>	<b>76</b>	<b>102</b>	<b>73</b>	<b>53</b>	<b>66</b>	<b>133</b>	<b>503</b>

*Source: Virginia Department of Forestry*

## **Hazard Profile**

Wildfires can be classified as either a wildland fire or an urban-wildland interface (UWI) fire. The former involves situations where wildfire occurs in an area that is relatively undeveloped except for the possible existence of basic infrastructure such as roads and power lines. An urban-wildland interface fire includes situations in which a wildfire enters an area that is developed with structures and other human developments. In UWI fires, the fire is fueled by both naturally occurring vegetation and the urban structural elements themselves. According to the National Fire Plan issued by the U.S. Departments of Agriculture and Interior, the urban-wildland interface is defined as “...the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildlands or vegetative fuels.”

A wildfire hazard profile is necessary to assess the probability of risk for specific areas. Certain conditions must be present for a wildfire hazard to occur. A large source of fuel must



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be present; the weather must be conducive (generally hot, dry, and windy); and fire suppression sources must not be able to easily suppress and control the fire. Once a fire starts, topography, fuel, and weather are the principal factors that influence wildfire behavior. According to the Virginia Department of Forestry, there are several factors that influence an area's risk to the occurrence of wildfires. These include, but are not limited to:

- Historical Wildfire Data
- Land Cover
- Percent Slope of Topography
- Slope Orientation
- Population Density
- Distance to Roads
- Railroad Buffer
- Road Density and Developed Areas

### **Fire Seasons**

The Virginia wildfire season is normally in the spring (March and April) and then again in the fall (October and November). During these months, the relative humidity is usually lower and the winds tend to be higher. In addition, the hardwood leaves are on the ground, providing more fuel and allowing the sunlight to directly reach the forest floor, warming and drying the surface fuels.

As fire activity fluctuates during the year from month to month, it also varies from year to year. Historically extended periods of drought and hot weather can increase the risk of wildfire. Some years with adequate rain and snowfall amounts keep fire occurrences low; while other years with extended periods of warm, dry, windy, days exhibit increased fire activity.

Long-term climate trends as well as short term weather patterns play a major role in the risk of wildfires occurring. For instance, short term heat waves along with periods of low humidity can also increase the risk of fire, while high winds directed at a fire can cause it to spread rapidly.

### **Secondary Effects**

There are numerous secondary effects that could impact the study area due to wildfires. Areas that have been burned due to wildfire have an increased risk of flooding and landslides in the event of heavy rains. Additional secondary impacts due to wildfire include a

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degradation of air and water quality, as well as a threat to wildlife habitat including endangered species.

### **Hazard Areas**

VDOF used GIS to develop a statewide spatial Wildfire Risk Assessment model to identify areas where conditions are more conducive and favorable to wildfire occurrence and advancement. This model incorporated the factors listed in the Hazard Profile section and weighted them on the scale of 0 to 10, with 10 representing the characteristic of each factor that has the highest wildfire risk. With this model VDOF identified areas of the study area as having a wildfire risk level of High, Medium, or Low. The results are shown on the maps included at the end of this section (Figure V-44 through V-50). New Kent and Charles City Counties have the largest amount of high risk areas while Henrico County and the City of Richmond have the least amount.

Hurricane Isabel downed thousands of trees in both New Kent and Charles City counties in 2003. While the counties removed the most hazardous trees from public facilities and many homeowners have removed trees from their property, thousands still remain. These trees provide an easy source of fuel for wildfires and create a high risk across the counties.

Goochland County has been working with VDOF to promote best management practices among landowners in the county. The Department and the county have offered joint courses on forestry management and wetlands protection. In addition, the county has thinned over 160 acres as part of instituting best management practices on county-owned property.

### **Vulnerability Analysis**

As stated in the section above, according the VDOF Wildfire Risk Assessment, small portions of the study area are at high risk for wildfire occurrence. These areas tend to be in the more rural parts of the study area. The residents that live within the urban-wildlife interface are at the greatest risk from potential wildfires.

#### **Structures at Risk**

As stated in the previous section, certain portions of the study area have been designated as having a high risk to wildfires as determined by VDOF. In an attempt to quantify the potential vulnerability in the areas, the approximate number of structures located in these areas has been estimated. As mentioned in earlier sections of this report, most of the counties included in the study area have a comprehensive GIS data that includes an inventory of building locations. With this data available, and because the VDOF Risk Assessment is also readily available in GIS format, determining the number of structures located in each Risk Wildfire zone was relatively simple. Table V-28 below includes the results of this analysis.



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**Table V-28 — Count of Structures in Wildfire Risk Zones**

<b>Jurisdiction</b>	<b>High Risk Zone</b>	<b>Medium Risk Zone</b>	<b>Low Risk Zone</b>	<b>Percent Structures in High Risk Zone</b>
<i>Charles City County</i>	2,841	877	64	75%
<i>Goochland County</i>	4,805	9,131	1,234	32%
<i>Hanover County</i>	15,984	51,851	21,458	18%
<i>Henrico County</i>	11,410	16,545	102,420	9%
<i>New Kent County</i>	3,711	1,733	97	67%
<i>Powhatan County</i>	Building data unavailable	Building data unavailable	Building data unavailable	Building data unavailable
<i>City of Richmond</i>	753	1,914	105,057	1%
<i>Sources: Virginia Department of Forestry; Community GIS data</i>				

As seen in Table V-28, Charles City and New Kent counties have the highest percentage of structures located in the high risk zone. These counties are rural and heavily forested, which accounts for difference in risk when compared to the rest of the study area. Goochland and Hanover counties, which also have large rural portions with extensive stands of forests, have the next highest percentage of structures in the high risk zone. Overall, less than one percent of the structures in the study area are in a high risk zone, 18% are in a medium risk zone, and 73% are in a low risk zone. These percentages do not include Powhatan County as no digital building data is available. Therefore, the overall risk to the region is understated.

It should be kept in mind that this analysis was done using building point locations. The analysis was not done at the parcel level but it is possible that a parcel falls into two risk zones. If this were the case, the analysis using building locations may underestimate the risk.

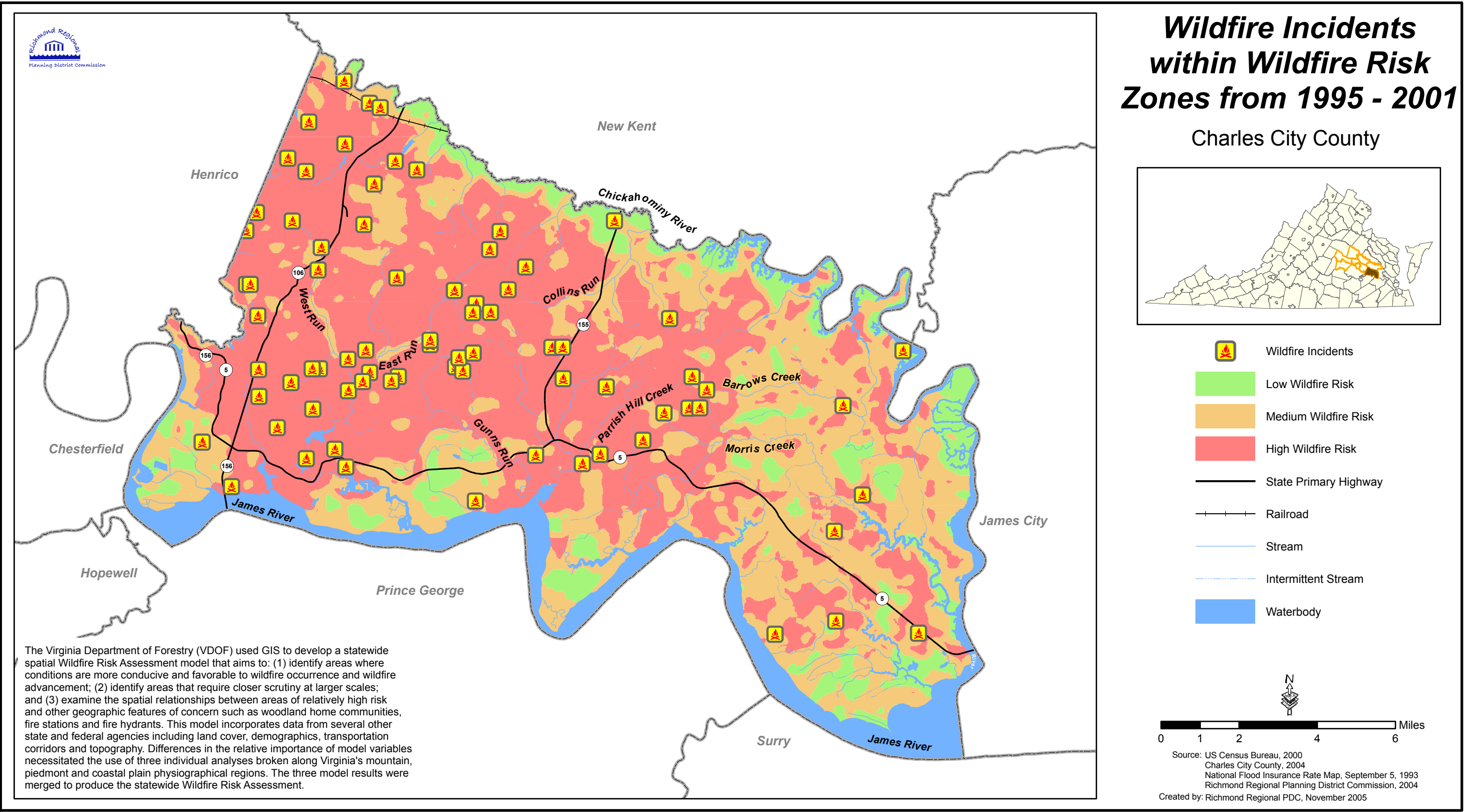


Figure V-44 - Charles City County Wildfire Incidents and Wildfire Risk Zones

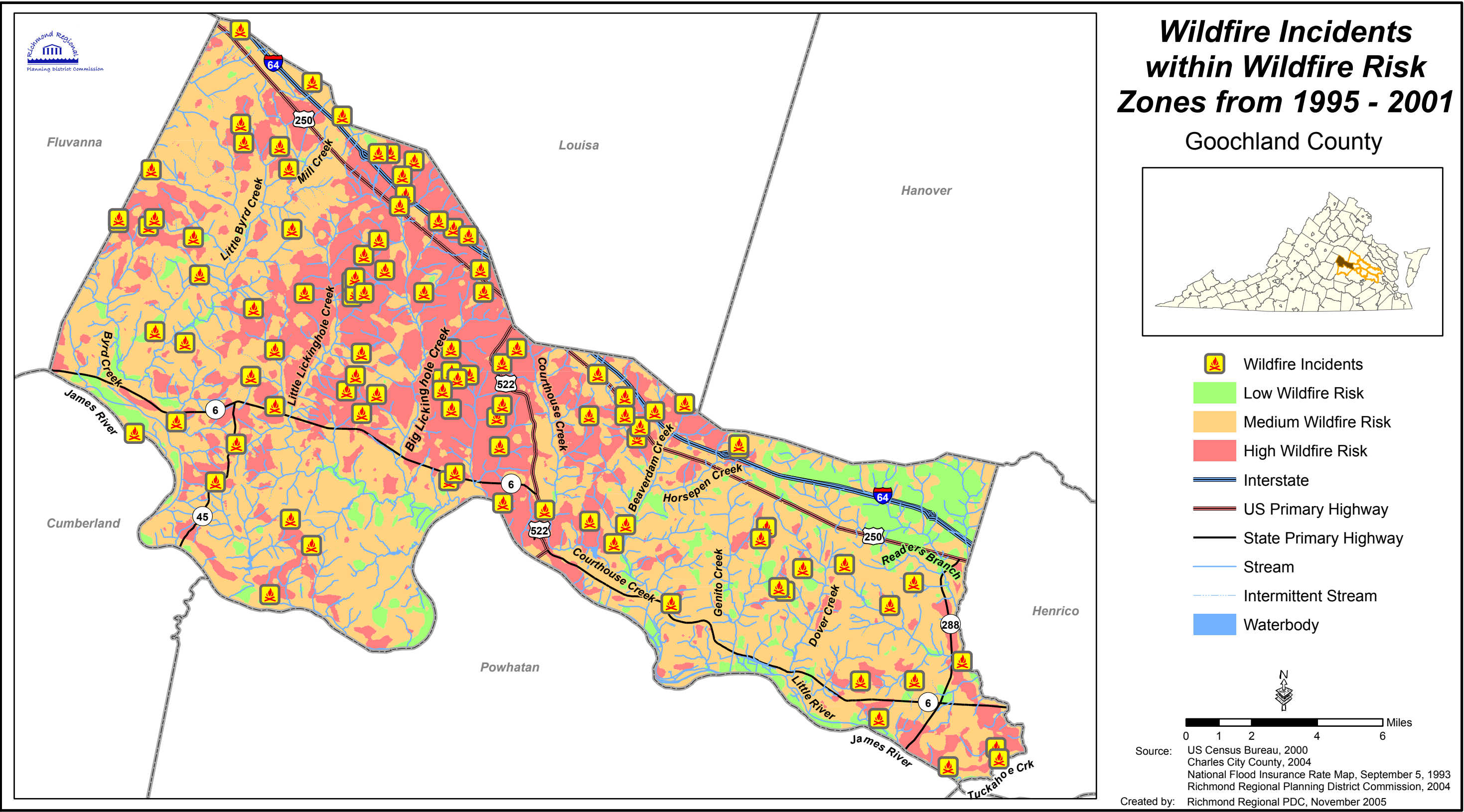


Figure V-45 - Goochland County Wildfire Incidents and Wildfire Risk Zones



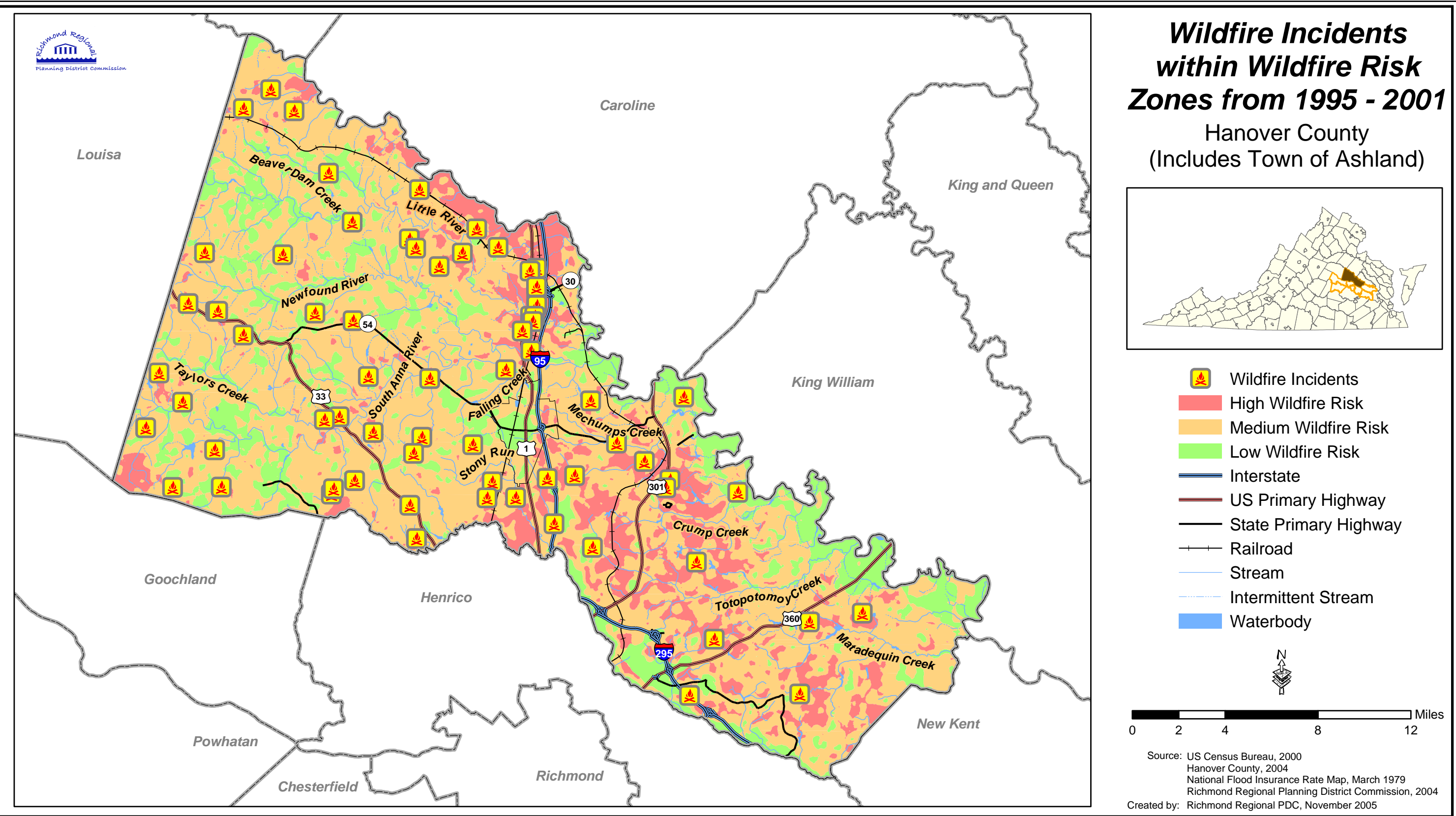


Figure V-46 - Hanover County and the Town of Ashland Wildfire Incidents and Wildfire Risk Zones

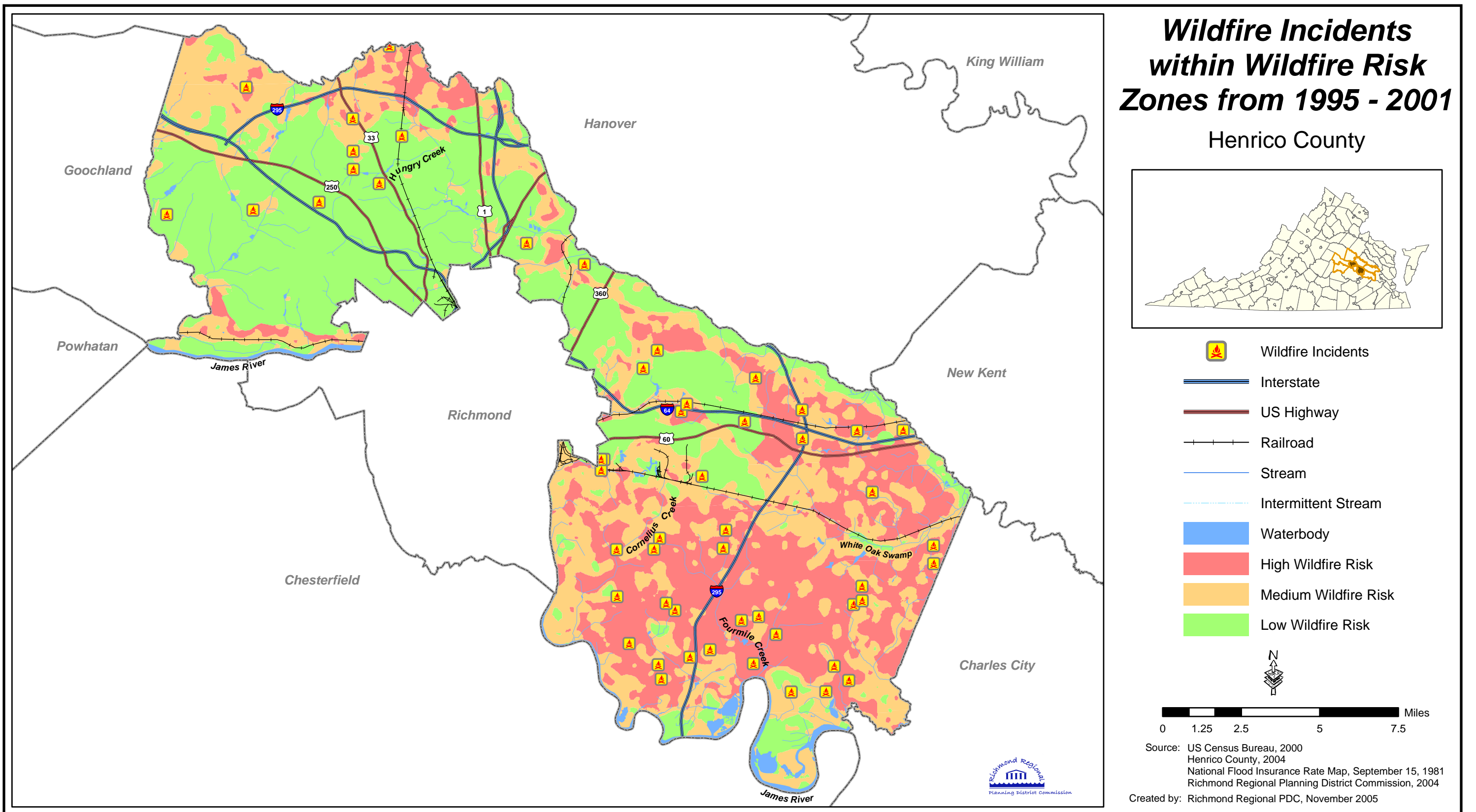


Figure V-47 - Henrico County Wildfire Incidents and Wildfire Risk Zones



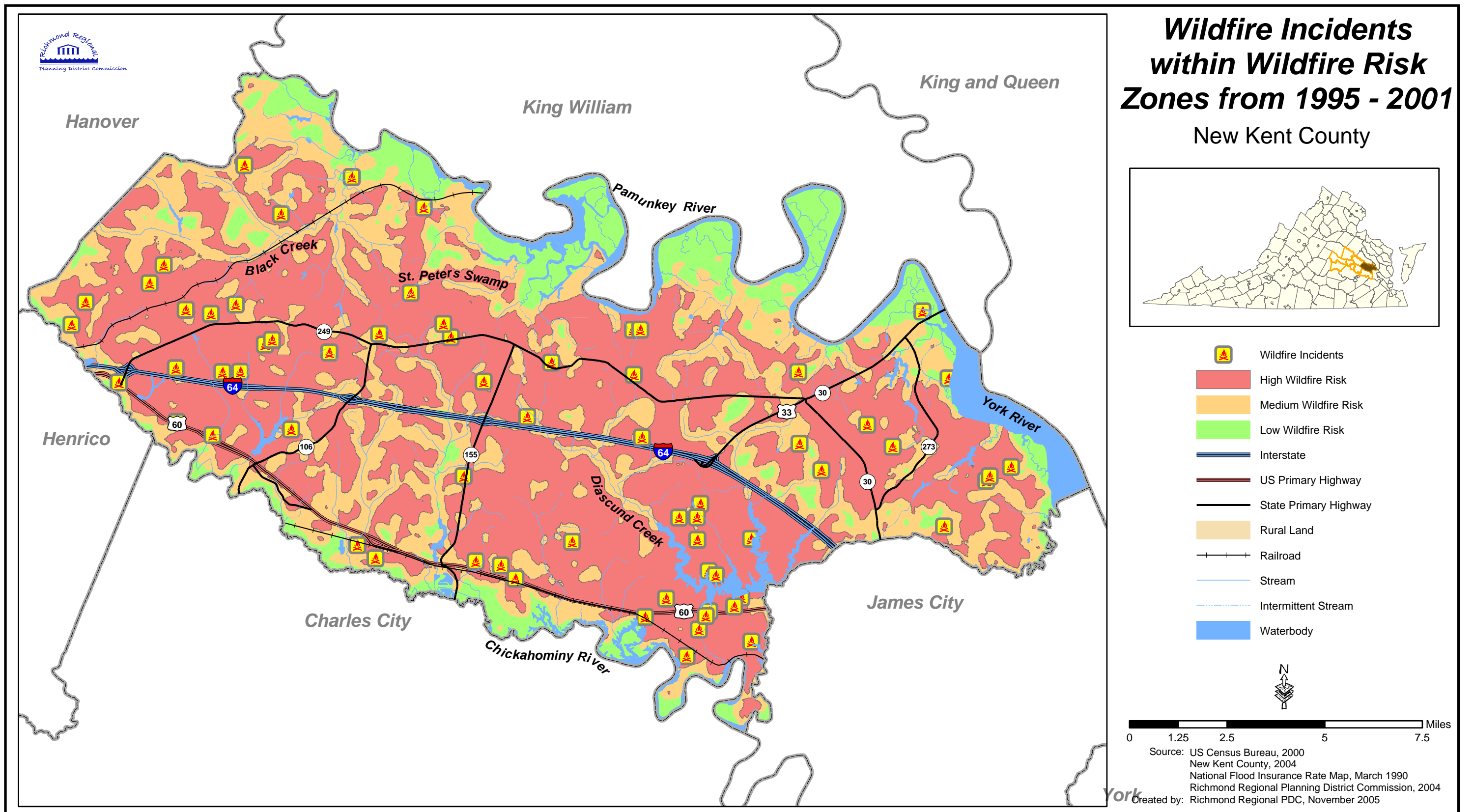


Figure V-48 - New Kent County Wildfire Incidents and Wildfire Risk Zones

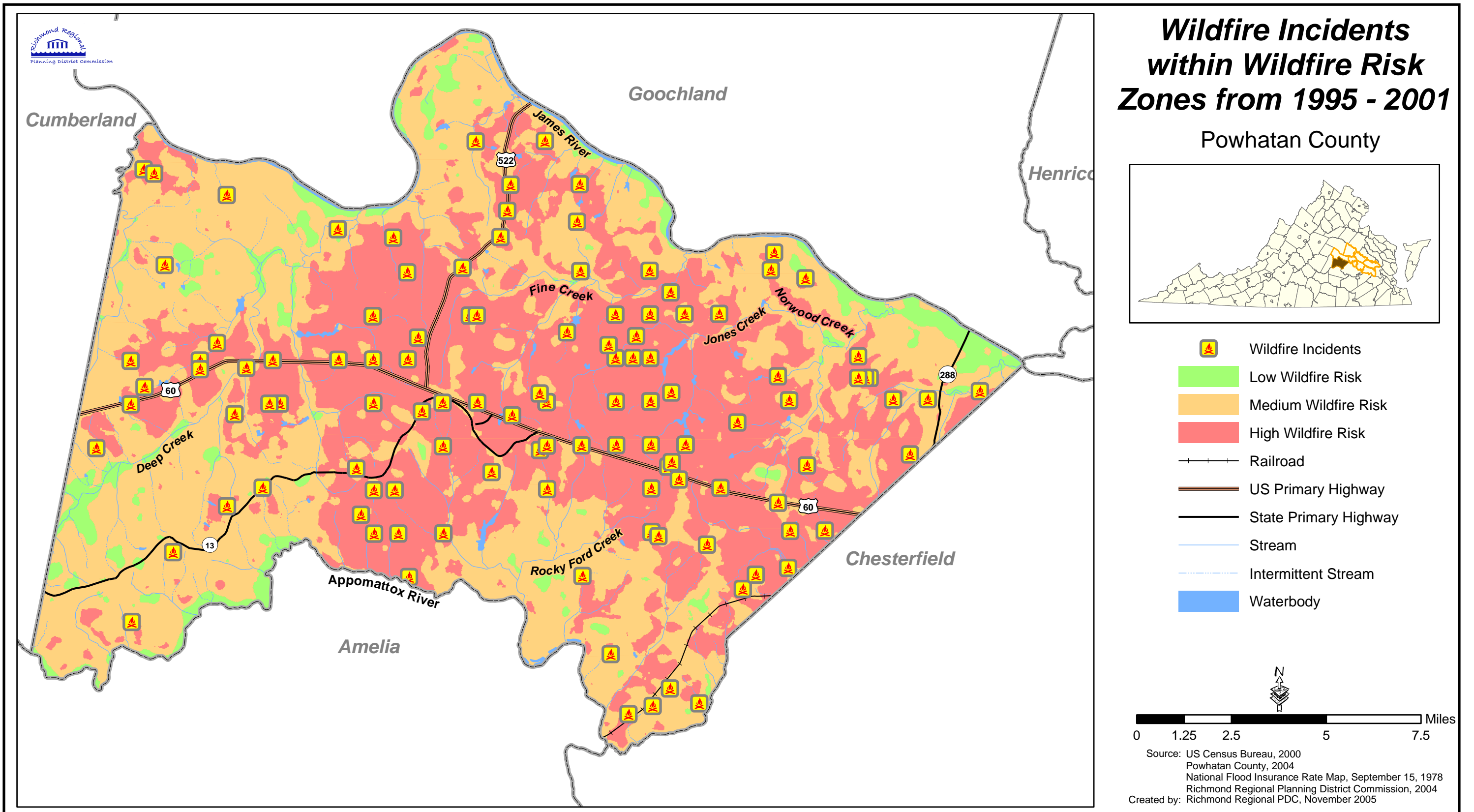
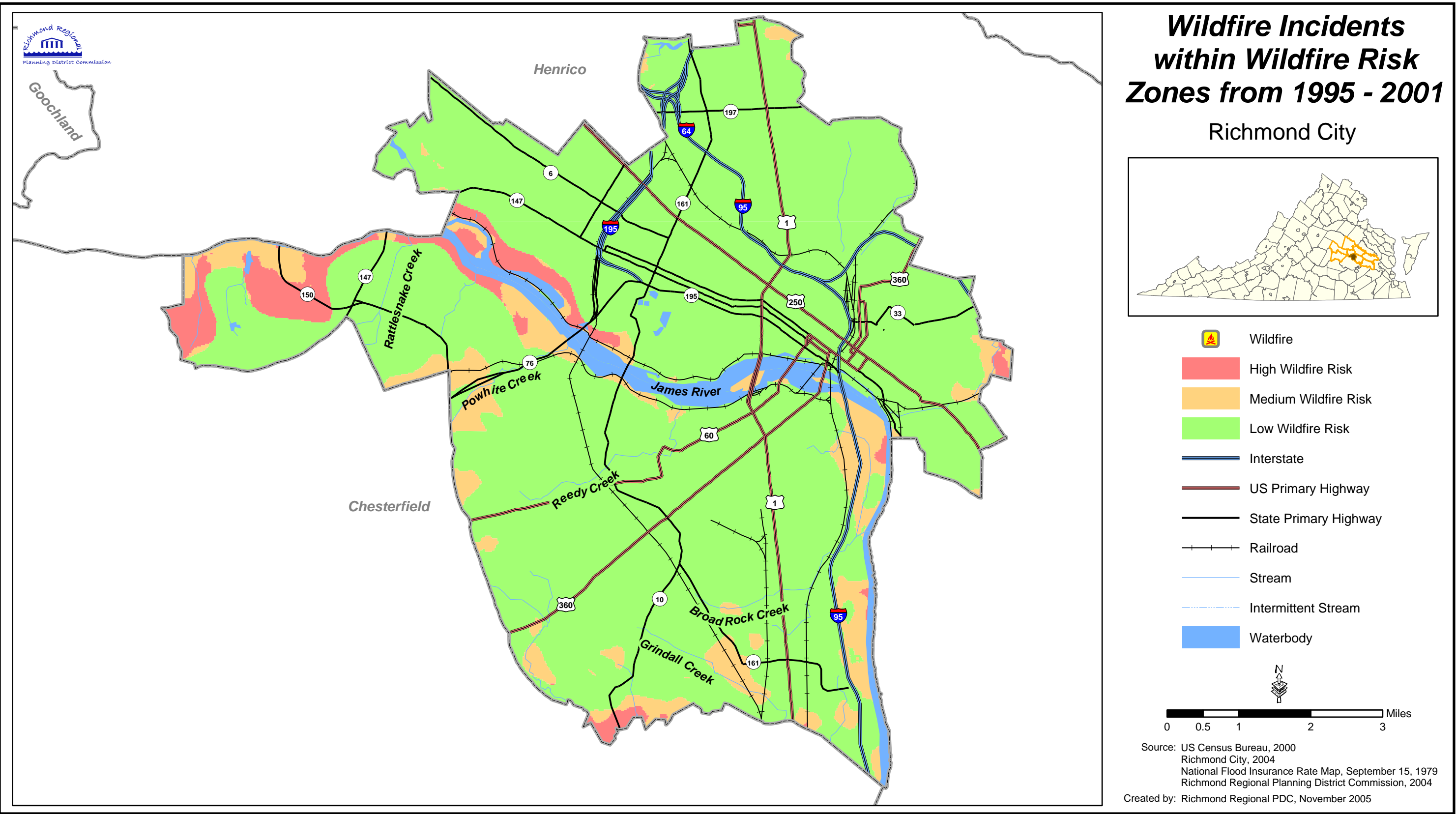


Figure V-49 - Powhatan County Wildfire Incidents and Wildfire Risk Zones

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V-50 - City of Richmond Wildfire Incidents and Wildfire Risk Zones



## **Section VI. CAPABILITY ASSESSMENT**

### ***Introduction***

This portion of the plan assesses the current capacity of the communities of the Richmond Regional Planning District to mitigate the effects of the natural hazards identified in Section V of the plan. This assessment includes a comprehensive examination of the following local government capabilities:

- ❖ *Staff and Organizational Capability* – describes the forms of government in the planning area including the departments that may be involved in hazard mitigation
- ❖ *Technical Capability* – addresses the technical expertise of local government staff
- ❖ *Fiscal Capability* – examines budgets and currently utilized funding mechanisms
- ❖ *Policy and Program Capability* – describes past, present and future mitigation projects in the planning area and examines existing plans (e.g., emergency operations plan, comprehensive plan)
- ❖ *Legal Authority* – describes how jurisdictions in the planning area use the four broad government powers (i.e., regulation, acquisition, taxation and spending) to influence hazard mitigation activities
- ❖ *Political Capability* – addresses political will and support for implementing mitigation

The purpose of conducting the capabilities assessment is to identify potential hazard mitigation opportunities available to seven of the Richmond Regional Planning District's local governments, specifically Charles City, Goochland, Hanover, Henrico, New Kent, and Powhatan counties, and the City of Richmond. Careful analysis should detect any existing gaps, shortfalls, or weaknesses within existing governmental activities that could exacerbate a community's vulnerability. The assessment also will highlight the positive measures already in place or being done at the local level, which should continue to be supported and enhanced, if possible, through future mitigation efforts.

The capabilities assessment serves as the foundation for designing an effective hazard mitigation strategy. It not only helps establish the goals and objectives for the planning district communities to pursue under this plan, but assures that those goals and objectives are realistically achievable under given local conditions.

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### ***Staff and Organizational Capability***

As described previously, the planning area is comprised of six counties and one city. The counties operate under a Board of Supervisors - County Administrator/Manager system. In this form of government, the elected board of supervisors hires a county administrator/manager who oversees daily operations of the county. Charles City County has the smallest board with three members. Goochland, Henrico, New Kent, and Powhatan counties each have five members on their Board of Supervisors. Hanover County's board is the largest in the planning area with seven members.

The City of Richmond operates under the City Council – Mayor system. The nine members of the council and the mayor are elected. They, in turn, appoint a chief administrative officer who oversees daily business operations of the city.

Under the county Administrator or Mayor, each jurisdiction has numerous departments and boards that are responsible for the various functions of local government. The following table (Table VI-1) highlights the departments in each jurisdiction that could facilitate the implementation of this hazard mitigation plan. The departments that have been assigned specifically delegated responsibilities to carry out mitigation activities or hazard control tasks for a specific jurisdiction are bolded and italicized. Representatives of these departments have been involved in the development of this mitigation plan in order to identify gaps, weaknesses or opportunities for enhancement with existing mitigation programs.

Table VI-1 – Key Departments	
Jurisdiction	Departments
Charles City County	<ul style="list-style-type: none"><li>• Fire</li><li>• Building Inspections</li><li>• <b><i>Department of Development</i></b></li><li>• <b><i>Public Works</i></b></li><li>• Recreation</li></ul>
Goochland County	<ul style="list-style-type: none"><li>• Building Inspections</li><li>• <b><i>Economic Development</i></b></li><li>• <b><i>Fire and Rescue</i></b></li><li>• Parks and Recreation</li><li>• Planning</li><li>• Public Works</li></ul>
Hanover County	<ul style="list-style-type: none"><li>• Building Inspections</li><li>• Economic Development</li><li>• <b><i>Fire/EMS</i></b></li></ul>

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Table VI-1 – Key Departments	
Jurisdiction	Departments
	<ul style="list-style-type: none"> <li>• Parks and Recreation</li> <li>• <b><i>Planning</i></b></li> <li>• Public Utilities</li> <li>• Public Works</li> <li>• <b><i>Sheriff</i></b></li> </ul>
Henrico County	<ul style="list-style-type: none"> <li>• Community Revitalization</li> <li>• Economic Development Authority</li> <li>• <b><i>Fire</i></b></li> <li>• Planning</li> <li>• Police</li> <li>• Public Utilities</li> <li>• Public Works</li> </ul>
New Kent County	<ul style="list-style-type: none"> <li>• Economic Development</li> <li>• Parks and Recreation</li> <li>• Planning</li> <li>• <b><i>Public Safety</i></b></li> <li>• Public Utilities</li> <li>• Public Works</li> </ul>
Powhatan County	<ul style="list-style-type: none"> <li>• Building</li> <li>• Economic Development</li> <li>• <b><i>Emergency Management</i></b></li> <li>• Fire</li> <li>• Planning and Community Development</li> </ul>
City of Richmond	<ul style="list-style-type: none"> <li>• Community Development</li> <li>• Economic Development</li> <li>• <b><i>Emergency Management</i></b></li> <li>• Fire</li> <li>• Parks and Recreation</li> <li>• Public Works</li> </ul>
<i>Source: Community websites; Mitigation Advisory Committee</i>	

While exact responsibilities differ from jurisdiction to jurisdiction, the general duties of the departments highlighted in Table VI-1 are described below.

- Building Inspections office enforces the Virginia Uniform Statewide Building Code (VUSBC). This code includes implications for building construction and floodplain management.

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- Department of Emergency Management/Fire/EMS/Public Safety is responsible for the mitigation, preparedness, response and recovery operations that deal with both natural and man-made disaster events. These departments typically encompass emergency management and fire safety. In addition, Fire/EMS departments provide medical aid and fire suppression at the scene of accidents and emergencies. These departments are often responsible for responding to hazardous materials incidents, water rescues and entrapments.
- Parks and Recreation departments may be responsible for open space programs. If acquisition projects are undertaken, coordination with this department becomes critical.
- The Planning Department (or Department of Development/Community Development) addresses land use planning. This department, depending on the jurisdiction, may enforce the National Flood Insurance Program requirements and other applicable local codes. Planning and Community Development departments are typically responsible for managing grant programs funded by the U.S. Department of Housing and Urban Development. These grant programs provide assistance to low and moderate income persons for needed home improvements. These departments also may develop residential and commercial revitalization plans for older areas, serve as a resource on housing and community development issues and undertake special redevelopment projects.
- Economic Development departments concentrate on ensuring the growth and prosperity of existing businesses. These departments often administer small business loan programs, state economic development programs, and workforce training programs. They also may recruit new businesses.
- Public Utilities, in some jurisdictions, oversees community water facilities or natural gas provision. In others, the Public Works Department oversees the maintenance of infrastructure including roadways, sewer and stormwater facilities and the community's water treatment facilities. These departments also may review new development plans, ensure compliance with stormwater management and erosion and sediment control regulations, and work with VDOT on road issues. Depending on the jurisdiction, the Department of Public Works may enforce the National Flood Insurance Program requirements.

For the most part, it was determined that the departments are adequately staffed, trained, and funded to accomplish their missions.

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***Technical Capability***

Mitigation cuts across disciplines. For a successful mitigation program, it is necessary to have a broad range of people involved with diverse backgrounds. These people include planners, engineers, building inspectors, emergency managers, floodplain managers, people familiar with Geographic Information Systems (GIS), and grant writers.

GIS systems can best be described as a set of tools (hardware, software and people) used to collect, manage, analyze and display spatially-referenced data. Many local governments are now incorporating GIS systems into their existing planning and management operations. GIS is invaluable in identifying areas vulnerable to hazards. Access to the Internet can facilitate plan development, public outreach, and project implementation.

Table VI-2 summarizes the technical capabilities of the jurisdictions. When provided, the specific department that has the technical capability is identified.

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**Table VI-2 — Technical Capability Matrix**

<i><b>Jurisdiction</b></i>	<i><b>Land Use Planners</b></i>	<i><b>Civil or Building Engineers</b></i>	<i><b>Emergency Manager</b></i>	<i><b>Floodplain Manager</b></i>	<i><b>Staff knowledgeable about hazards</b></i>	<i><b>GIS Staff</b></i>	<i><b>Grant Writers</b></i>
<i>Charles City County</i>	Development	Public Works	Public Works	Building Inspect.	Public Works	Development	Not department specific
<i>Goochland County</i>	Community Development/ Planning	Build Inspections/ Public Works	Fire-Rescue	Planning	Planning/Public Works	Community Development	Not department specific
<i>Hanover County</i>	Public Works/ Planning	Building Inspections/ Public Works/Public Utilities	Fire/EMS	Public Works	Planning/ Public Works/ Public Util./ Building Inspections/Fire/ EMS/Sheriffs	Planning	Planning/ Sheriffs/Fire/EMS
<i>Henrico County</i>	Planning	Building Inspections	County Manager/Fire	Planning	Planning/ Building Inspections/Fire/ Police	Planning	Not department specific
<i>New Kent County</i>	Planning/Community Development	Public Works (utilities only)	Fire Department	Planning	Planning/Fire Department	Information Technology	Not department specific
<i>Powhatan County</i>	Planning	Not department specific	Emergency Management	Planning	Emergency Management	None	Finance/ Emergency Management
<i>City of Richmond</i>	Public Works/ Community Development	Public Works/ Community Development	Emergency Management	Public Works	Public Works /Emergency Management/ Community Development	Public Works	Budget and Strategic Planning

*Source: Capability Assessment Survey Results*

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As can be seen in the table, most jurisdictions have one or more departments that have primary technical capability in each category. Charles City County and Powhatan County are developing GIS capabilities with the assistance of the Richmond Regional Planning District Commission. The staff at all of the jurisdictions have Internet access. All the counties except for Powhatan County have government websites that could be utilized to promote hazard mitigation.

***Fiscal Capability***

For Fiscal Year 2004, the budgets of the participating jurisdictions range from \$53,277,279 (Powhatan County) to \$1,194,002,482 (City of Richmond). Table VI-3 shows the total budget amounts for each jurisdiction in addition to the amount budgeted for public safety.

The counties and City of Richmond receive most of their revenue through local real estate tax, state and local sales tax, local services, and through restricted intergovernmental contributions (federal and state pass through dollars). It is unlikely that any of the counties or Richmond could easily afford to provide the local match for the existing hazard mitigation grant programs. Considering the current budget deficits at both the state and local government level, in Virginia, combined with the apparent increased reliance on local accountability by the federal government, this is a significant and growing concern.

Under the Disaster Mitigation Act of 2000, FEMA has made special accommodations for "small and impoverished communities," who will be eligible for a 90% federal share, 10% non-Federal cost share for projects funded through the Pre-Disaster Mitigation (PDM) grant program. The definition is restricted to "communities of 3,000 or fewer individuals that is identified by the State as a rural community." According to the current Interim Final Rule for Section 322 of the Act, none of the jurisdictions in the planning area will qualify as a small and impoverished community.

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**Table VI-3— Fiscal Capability Matrix**

<i>Jurisdiction</i>	<i>Overall FY04-05 Budget</i>	<i>Public Safety FY04-05 Budget</i>
<i>Charles City County</i>	N/A	N/A
<i>Goochland County</i>	N/A	N/A
<i>Hanover County</i>	\$154,195,000	\$30,209,185
<i>Henrico County</i>	\$586,729,814	\$111,478,664
<i>New Kent County</i> <sup>59</sup>	\$64,443,455	\$562,862
<i>Powhatan County</i>	\$53,277,279	\$3,326,709
<i>City of Richmond</i> <sup>60</sup>	\$1,194,002,482	\$32,210,901
<i>Sources: County budget offices</i>		

As can be seen in Table VI-4, the jurisdictions in the study area have a variety of fiscal tools at their use. The ability to use these tools for hazard mitigation differs from jurisdiction to jurisdiction. As can be seen in the table, only one jurisdiction, Hanover County has chosen to use development impact fees. Most communities use capital improvement plans and general obligation bonds to plan and fund large-scale public expenditures. Most jurisdictions in the study area also use intergovernmental agreements to leverage resources.

<sup>59</sup> Public Safety number represents Fire & Emergency Management Department expenditures.

<sup>60</sup> Public Safety number represents Fire & Emergency Services expenditures.



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**Table VI-4 – Financing Mechanisms by Jurisdiction**

<i><b>Jurisdiction</b></i>	<i>Development impact fees</i>	<i>Capitol improvement programming</i>	<i>CDBG</i>	<i>General obligation, revenue and/or special tax bonds</i>	<i>Special purpose taxes or taxing district</i>	<i>Gas/electric fees</i>	<i>Water/sewer fees</i>	<i>Stormwater utility fees</i>	<i>Intergovern- mental agreements</i>	<i>E911 telephone tax</i>
<i>Charles City County</i>		✓	✓	✓		✓	✓		✓	✓
<i>Goochland County</i>		✓	✓	✓	✓		✓	✓	✓	✓
<i>Hanover County</i>	✓	✓	✓	✓	✓		✓		✓	✓
<i>Henrico County</i>		✓	✓	✓			✓	✓	✓	✓
<i>New Kent County</i>		✓	✓	✓	✓	Taxes	✓		✓	✓
<i>Powhatan County</i>		✓			✓		✓		✓	✓
<i>City of Richmond</i>		✓	✓	✓	✓	✓	✓		✓	✓
<i>Source: Capability Assessment Survey Results</i>										

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## ***Policy and Program Capability***

### **Previous Mitigation Efforts**

#### **Charles City County**

Charles City County did not report any mitigation projects to include in this report.

#### **Goochland County**

Goochland County has been working with the Virginia Department of Forestry to promote best management practices among landowners in the county. The department and the county have offered joint courses on forestry management and wetlands protection. In addition, the county has thinned over 160 acres as part of instituting best management practices on county-owned property.

#### **Hanover County**

Hanover County has submitted an application for a FEMA Hazard Mitigation Grant Program grant for a project in the Gardner Estates area. The Gardner Estates area encompasses a watershed of approximately 46 acres which drains to a low point with no means for the release of stormwater runoff except through infiltration. The watershed has developed residentially over the past several decades. Hanover County accepted maintenance responsibilities for an infiltration basin during that time. This basin has been maintained with a healthy growth of trees to promote evaporation and transpiration. During the past five years, Hanover County has documented flooding of crawlspaces and accessory residential structures, as well as flooding of conventional septic systems, creating the potential for prolonged failure of the residential sewage systems and other related health concerns. In addition, larger events such as Hurricane Isabel and Tropical Storm Gaston have resulted in more significant damages.

The proposed project includes the construction and installation of approximately 1,850 feet of 42-inch storm sewer pipe capable of handling the anticipated peak flow resulting from a 100-year storm event. The project will eliminate routine flooding of the area including crawl spaces, accessory structures and conventional septic and well systems, and will protect the first floor elevations of up to the 100-year flood event. This will prevent significant flood-related losses and potential health and safety risks associated with failed septic and contaminated well systems. Additionally, this project represents relatively low long-term operation and maintenance costs to the County.

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*Henrico County*

The Flood Insurance Study for Henrico County references removal of homes in the Capistrano Gardens area that has eliminated flood problems. The study was completed in 1980 so this project was done over 24 years ago.

*New Kent County*

New Kent County did not report any mitigation projects to include in this report.

*Powhatan County*

Powhatan County has no mitigation projects to include in this report.

*City of Richmond*

One of the most prominent mitigation efforts in the Richmond region has been the James River floodwall, in the City of Richmond. The floodwall was completed in 1994 for a cost of approximately \$134 million. The floodwall has allowed the redevelopment of the Richmond Riverfront, stretching along the James River from the historic Tredegar Iron Works site, just west of 7th Street, to 17th Street in downtown Richmond. Considerable reinvestment in this area was sparked by the reduction in flooding that the floodwall promised.<sup>61</sup>

As was seen by the floods caused by Tropical Storm Gaston in 2004, the floodwall does not mean that the area known as Shockoe Bottom is immune from flooding. The following quote from a news report after the flooding captures the issue:

“We didn’t know it would lock everything in,” said Karen Empey, general manager of the Rivah Bistro. “We did not get flood insurance because per my insurance agent, I didn’t need it because of the floodwall. It gave us a sense of security, a false one.”<sup>62</sup>

According to a March 2005 report from FEMA to Congress, the floodwall project was designed to protect the city from a 1% annual chance of flooding from the James River and a 1.6% annual chance of flooding from interior sources, not from extreme interior floods. Drainage features that are part of the floodwall project, such as the East Gravity Outlet, improved drainage in the area from more likely to occur interior flood events such as the 1% annual chance flood. The city received about 14 inches of rain from Tropical Storm Gaston, which the stormwater system was not able to manage effectively. These events highlight the need for education about mitigation and that it is not possible to eliminate natural disasters.

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<sup>61</sup> Historic Richmond Region – History. Retrieved from [www.richmondva.org/HTML/About\\_Richmond/History.lasso](http://www.richmondva.org/HTML/About_Richmond/History.lasso)

<sup>62</sup> Richmond.Com. Thursday September 2, 2004. Retrieved on September 2, 2004 from [www.richmond.com/business/output.cfm?ID=3224693&vertical=business](http://www.richmond.com/business/output.cfm?ID=3224693&vertical=business)

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The City of Richmond has applied for funding from the U.S. Department of Housing and Community Development to fund the Broad Rock Creek Floodway Mitigation Project. This project will assist in the reconstruction or acquisition, demolition and relocation of 14 identified homes and up to six others in the city located in the Broad Rock Creek floodway and adjacent 100-year floodplain that sustained severe damage as a result of the remnants of Tropical Storm Gaston in 2004.<sup>63</sup>

### **Emergency Operations Plan**

A Comprehensive Emergency Management Plan typically predetermines actions to be taken by government agencies and private organizations in response to an emergency or disaster event. For the most part, the plan describes the jurisdiction's capabilities to respond to emergencies and establishes the responsibilities and procedures for responding effectively to the actual occurrence of a disaster.

Of the five plans developed by participating jurisdictions, only one specifically addressed hazard mitigation. The plans do identify the specific operations to be undertaken by the county and city to protect lives and property immediately before, during and immediately following an emergency. There are no foreseeable conflicts between this Hazard Mitigation Plan and any of the emergency operations plans in the study area, primarily because they are each focused on separate phases of emergency management (mitigation vs. preparedness and response).

Charles City also is covered by the Surry County Nuclear Power Plant Emergency Operations Plan.

### **Floodplain Management**

Communities that regulate development in floodplains are able participate in the National Flood Insurance Program (NFIP). In return, the NFIP makes federally-backed flood insurance policies available for properties in the community. Table VI-5 shows when each of the jurisdictions began participating in NFIP. The table also provides the date of the Flood Insurance Rate Map (FIRM) in effect in each community. These maps were developed by FEMA or its predecessor and show the boundaries of the 100 year and 500 year floods. As the table shows, four of the maps are over twenty years old and two of the maps are almost fifteen years old. Much of the planning area has experienced dramatic growth over the past decade that is not reflected in the FIRM. This difference may mean that the actual floodplain varies significantly from that depicted on the map.

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<sup>63</sup> City of Richmond. *City to Apply for Grant Funding for Disaster Recovery*. Retrieved from [www.ci.richmond.va.us/departments/communityDev/](http://www.ci.richmond.va.us/departments/communityDev/) on July 25, 2005.

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**Table VI-5— NFIP Entry and FIRM Date**

<i>Jurisdiction</i>	<i>Entry into NFIP</i>	<i>Date of Current FIRM</i>	<i>Stand alone or part of zoning ordinance?</i>
<i>Town of Ashland*</i>	5/26/1978	No SFHA	-
<i>Charles City County</i>	9/5/1990	9/5/1990	Zoning
<i>Goochland County</i>	3/1/1979	3/1/1979	Zoning
<i>Hanover County</i>	9/2/1981	9/2/1981	Stand alone
<i>Henrico County</i>	2/4/1981	2/4/1981	Stand alone
<i>New Kent County</i>	12/5/1990	12/5/1990	Zoning
<i>Powhatan County</i>	9/15/1978	9/15/1978	Zoning
<i>City of Richmond</i>	6/15/1979	7/20/1998	Stand alone
<i>Land annexed by the Town of Ashland in 1996 is within Special Flood Hazard Area (SFHA) – see Hanover County FIRM for details.</i>			
<i>Source: Federal Emergency Management Agency. Community Status Book.</i>			

Virginia State statutes provide cities and counties the land use authority. In particular, issues such as floodwater control are empowered through §15.2-2223 and §15.2-2280. All of the jurisdictions in the planning area have adopted a local floodplain ordinance as a requirement of participation in the National Flood Insurance Program. Table VI-5 shows if the community has adopted a stand alone ordinance or if it has incorporated floodplain regulations into its zoning ordinance.

The Community Rating System (CRS), administered by FEMA, was implemented in 1990 as a program for recognizing and encouraging community floodplain management activities that exceed the minimum NFIP standards. Residents of communities that participate in CRS receive a reduction in the flood insurance premium. There are ten CRS classes: class 1 requires the most credit points and gives the largest premium reduction; class 10 receives no premium reduction. None of the jurisdictions in this hazard mitigation plan are members of the CRS.

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One of the CRS requirements is a community floodplain management plan. The Richmond Regional Hazard Mitigation Plan is intended to fulfill the CRS planning requirement should the planning jurisdictions decide to enter the CRS.

### **Comprehensive Plan**

A community's comprehensive plan provides the future vision for the community regarding growth and development. Hazard mitigation planning is not specifically addressed in any of the comprehensive plans in the study area. However, many of the plans include land use or environmental protection goals that could support future mitigation efforts. For example, by limiting development in the floodplain (which is considered mitigation) also may help meet open space goals laid out in a comprehensive plan.

For the most part, these strategies address development in the floodplain or otherwise flood-prone areas. In addition, the plans indicate that communities in the study area are experienced with and willing to use growth management tools such as zoning, subdivision regulations and preferential tax assessment.

Appendix G provides excerpts and greater detail on each jurisdiction's comprehensive plan.

#### **Charles City County**

Charles City County's relatively undeveloped state present challenges and opportunities. The Comprehensive Land Use Plan strikes a balance between promoting residential development and industrial development while also instituting policies to ensure that the county's rich natural and historic resources are protected. The comprehensive plan recognizes the need to ensure that development is appropriate to the carrying capacity of the land. In particular, the plan states that development in and adjacent to floodplains, and other sensitive areas should occur in a manner that protects the environment. The plan advocates for strict compliance with the county floodplain ordinance. In addition, the plan suggests that development along the river or shoreline provide an impact analysis and justification for locating on the shoreline.

The 1996 Master Water and Sewer Plan for the county followed the guidance of the comprehensive plan and targets future public utilities to designated development areas. Rather than a county-wide sewer system, the county has developed numerous low-pressure sewer systems (up to 100,000 gallon) in conjunction with EPA and Department of Housing and Community Development grants and developers that serve individual neighborhoods.

#### **Goochland County**

Goochland County's comprehensive plan lays out a future that includes residential development that promotes the health, safety and welfare of Goochland residents.

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Floodplains and steep slopes are recognized as needing special protection which is done via a natural resource area designation. One strategy included in the comprehensive plan is to permanently protect twenty percent of the county from development. This strategy is being achieved through conservation easements given as part of cluster development projects in the county.

An important element of the plan is to guide growth to villages and designated growth centers, rather than allowing a more sprawling pattern. Part of this strategy includes providing recreational opportunities including using a floodplain for a river access.

The plan also requires that new utility distribution lines be placed underground; this is implemented through the county's subdivision regulations. In addition, the plan requires that sites for community facilities be chosen on the basis of acceptable topography, soils, and other physical traits as well as other criteria.

It is clear from the plan that Goochland County is comfortable using a wide range of growth management tools including zoning, subdivision regulations, capital improvements programming, building and housing codes, and preferential tax assessments.

#### *Hanover County*

Hanover County has a growth management approach similar to Goochland County. One of Hanover's goals is to protect natural and cultural resources while providing for adequate areas to accommodate planned growth. The comprehensive plan calls for evaluating the benefits of preserving land, including floodplains and excessively steep slopes from development. Open space protection, focused in part on protecting floodplains, is designated as one of the criteria to be used when evaluating development proposals.

#### *Henrico County*

One of the overarching goals laid out in the Henrico County Comprehensive Plan is to promote the protection of natural resources by respecting the physical limitations of the land. Numerous goals and objectives relate to this overarching one. For instance, a residential objective states that development should be discouraged in areas where the land's physical limitations may threaten the safety, health, and welfare of residents. A corresponding policy is to encourage the rezoning of flood plain areas to a conservation designation.

A particularly innovative environmental policy is to require conspicuous statements on all subdivision plats to alert prospective purchasers of pre-existing conditions (e.g., floodplains) that may be hazardous.



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The Community Development Block Grant/HOME plan for Henrico County highlights the need for flood drain improvements as part of the community development priorities.

*New Kent County*

The overarching goal of New Kent County's comprehensive plan is to protect the natural environment. Steep slopes, wetlands and floodplains are recognized as sensitive areas in need of protection. One of the natural resource protection strategies calls for adopting and maintaining floodplain protection measures in county ordinances and policies. A variety of conservation mechanisms, such as easements, clustering, and purchase/transfer of development rights, are suggested in the plan.

*Powhatan County*

Powhatan County's overarching goal is to maintain the rural character of the county, in part by protecting features such as rivers, streams and creeks. The five-acre average for residential development in rural areas helps to maintain the rural character. Higher densities are allowed only in the village areas and only if public utilities are provided. Generally, the plan seeks to promote compact development.

Roughly 80% of Powhatan County is designated as a Rural Preservation Area with a base density of one dwelling unit per ten acres. The Comprehensive Plan allows properties in the Rural Preservation Area to be rezoned to an average of one dwelling per five acres with a minimum lot size of two acres. Applicants are encouraged to make use of this lot averaging method to provide cluster developments with open space areas in excess of twenty acres that are placed in conservation easements. The plan also recommends that applicants using this method provide buffer areas and environmentally-sensitive lot layouts.

Powhatan County's plan also contains a number of policies related to environmental protection. These policies include those related to floodplains and include the use of buffers along streams and rivers. Previous efforts to include wildfire mitigation principles in the county comprehensive plan have failed.

*City of Richmond*

The City of Richmond is largely built out. Most development in the city will be redevelopment of previously built sites. This lack of supply may create a market demand to develop in potentially hazardous areas such as along the James River. One of the goals of the City's master plan, however, is to ensure that environmentally sensitive lands are protected from harmful and inappropriate land uses. The plan specifically cites the need to prevent development in the floodplain. The master plan also recognizes the role that urban forests play in reducing flooding.

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The City also has a Downtown Plan. Significant recommendations include the expansion of open space along the river and an increase in mixed use and residential development. One of the areas suggested for such development is Shockoe Bottom, which experienced record flooding in August 2004. Another recommendation was for a downtown transit circulator consisting of an at-grade light rail transit system. Part of the suggested route was the Shockoe Bottom and Shockoe Slip areas. When projects such as these are proposed for potentially hazardous areas, the potential risk should be considered as part of the proposed costs.

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**Table VI-6 — Availability of Plans and their Support for Hazard Mitigation**

<i><b>Jurisdiction</b></i>	<i><b>CIP</b></i>	<i><b>Comp. LU Plan</b></i>	<i><b>Econ. Dev. Plan</b></i>	<i><b>Emergency Operations Plan</b></i>	<i><b>Floodplain Management Plan</b></i>	<i><b>HazMat Plan</b></i>	<i><b>Historic Pres. Plan</b></i>	<i><b>Local Hazard Mitigation Plan</b></i>	<i><b>Open Space Plan</b></i>	<i><b>Post- Disaster Redev. Plan</b></i>	<i><b>Rad. Response Plan</b></i>	<i><b>StormH<sub>2</sub>O Management Plan</b></i>
<i>Charles City County</i>	M	M	M	M	M	M	M	UD	UD	M	M	N/A
<i>Goochland County</i>	M	H	N/A	M	M	M	M	UD	N/A	M	M	✓
<i>Hanover County</i>	H	M	M	H	H	H	M	UD	H	UD	H	H
<i>Henrico County</i>	H	M	N/A	H	H	H	✓	H	✓	Recovery Plan	H	H
<i>New Kent County</i>	M	M	UD	H	M	H	✓	UD	UD	N/A	H	H
<i>Powhatan County</i>	M	M	N/A	H	H	M	N/A	UD/Included in EOP	N/A	N/A	M	N/A
<i>City of Richmond</i>	UD	M	UD	UD	UD	✓	✓	UD	✓	UD	✓	UD

✓ = Plan exists, no assessment of relationship to hazard mitigation

H = Strongly supports = specifically includes hazard mitigation

M = Helps facilitate = elements could be used to support hazard mitigation

L = Hinders = no mention of hazard mitigation and does not contain elements that would support hazard mitigation or includes elements that would hinder hazard mitigation

UD = Under development

*Source: Capability Assessment Survey Results*

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### ***Legal Authority***

Local governments in Virginia have a wide range of tools available to them for implementing mitigation programs, policies and actions. A hazard mitigation program can utilize any or all of the four broad types of government powers granted by the State of Virginia, which are (a) regulation, (b) acquisition, (c) taxation, and (d) spending. The scope of this local authority is subject to constraints, however, as all of Virginia's political subdivisions must not act without proper delegation from the state. All power is vested in the state and can only be exercised by local governments to the extent it is delegated (in accordance with Dillon's Rule). Thus, this portion of the capabilities assessment will summarize Virginia's enabling legislation that grants the four types of government powers listed above within the context of available hazard mitigation tools and techniques.

### **Regulation**

#### **General Police Power**

Virginia's local governments have been granted broad regulatory powers in their jurisdictions. Virginia State Statutes bestow the general police power on local governments, allowing them to enact and enforce ordinances which define, prohibit, regulate or abate acts, omissions, or conditions detrimental to the health, safety, and welfare of the people, and to define and abate nuisances (including public health nuisances). Since hazard mitigation can be included under the police power (as protection of public health, safety and welfare), towns, cities and counties may include requirements for hazard mitigation in local ordinances. Local governments also may use their ordinance-making power to abate "nuisances," which could include, by local definition, any activity or condition making people or property more vulnerable to any hazard.

All of the jurisdictions in the planning area have enacted and enforce regulatory ordinances designed to promote the public health, safety, and general welfare of its citizenry. Appendix G provides excerpts and greater detail on each jurisdiction's relevant ordinances including zoning and floodplain management ordinances.

#### **Land Use**

Regulatory powers granted by the state to local governments are the most basic manner in which a local government can control the use of land within its jurisdiction. Through various land use regulatory powers, a local government can control the amount, timing, density, quality, and location of new development. All these characteristics of growth can determine the level of vulnerability of the community in the event of a natural hazard. Land use regulatory powers include the power to engage in planning, enact and enforce zoning ordinances, floodplain ordinances, and subdivision controls. Each local community possesses legal authority to prevent unsuitable development in hazard-prone areas.

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### *Planning*

According to State Statutes, local governments in Virginia may create or designate a planning agency. The planning agency may perform a number of duties, including:

- ❖ Make studies of the area;
- ❖ Determine objectives;
- ❖ Prepare and adopt plans for achieving those objectives;
- ❖ Develop and recommend policies, ordinances, and administrative means to implement plans; and
- ❖ Perform other related duties.

The importance of the planning powers of local governments is illustrated by the requirement that zoning regulations be made in accordance with a comprehensive plan. While the ordinance itself may provide evidence that zoning is being conducted “in accordance with a plan,” the existence of a separate planning document ensures that the government is developing regulations and ordinances that are consistent with the overall goals of the community. All of the jurisdictions within the study area have planning departments and comprehensive plans.

### *Zoning*

Zoning is the traditional and most common tool available to local governments to control the use of land. Broad enabling authority is granted for municipalities and counties in Virginia to engage in zoning. Land “uses” controlled by zoning include the type of use (e.g., residential, commercial, and industrial) as well as minimum specifications that control height and bulk such as lot size, building height and set backs, and density of population. Local governments are authorized to divide their territorial jurisdiction into districts, and to regulate and restrict the erection, construction, reconstruction, alteration, repair or use of buildings, structures, or land within those districts. Districts may include general use districts, overlay districts, and special use or conditional use districts. Zoning ordinances consist of maps and written text.

Currently, Charles City County is updating its zoning ordinance. As part of the update process, the county asked the Virginia Department of Forestry to complete a review of Charles City County’s proposed zoning ordinance. In December 2004, the department provided suggestions on how to address forestry and wildfire mitigation concerns in the zoning ordinance. The county is considering these recommendations.

Goochland, New Kent and Powhatan counties implement floodplain regulations via the zoning ordinance. An overlay district is used to impose additional requirements on properties within the designated floodplain area. The other jurisdictions implement floodplain regulations as stand-alone ordinances.

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### *Subdivision Regulations*

Subdivision regulations control the division of land into parcels for the purpose of building development or sale. Flood-related subdivision controls may prohibit the subdivision of land subject to flooding unless flood hazards are overcome through filling or other measures. Subdivision regulations, however, generally prohibit filling of floodway areas. For example, you may be allowed to fill the area next to a stream but not the stream itself. The regulations also typically require that sub-dividers, once construction begins, install adequate drainage facilities and design water and sewer systems to minimize flood damage and contamination.

All of the jurisdictions in the study area have adopted a subdivision ordinance. Some of the ordinances contain floodplain-specific provisions. For instance, Powhatan County requires a 100-foot natural vegetative buffer along all perennial streams as well as setbacks for residential structures from the floodplain. In New Kent County, new subdivisions with 50 or more homes are required to have at least two ingresses and egresses. This requirement will allow an alternate route if one is blocked in case of emergency. Since subdivisions of four lots or more trigger major subdivision review standards in Charles City County, most subdivisions are smaller to avoid these more rigorous standards.

### *Floodplain Regulation*

All of the communities in the study area have adopted floodplain regulations. Powhatan County's regulations have been in place since 1973, prior to joining the National Flood Insurance Program (NFIP). The other jurisdictions adopted floodplain regulations after joining the NFIP (see Table VI-5 for date of entry).

Generally, the regulations adopted by the study communities do not go beyond the minimum standards of the National Flood Insurance Program. Table VI-7 summarizes the key features of the regulations in the Richmond region. Only Goochland and Powhatan counties restrict uses in the floodplain. The majority of communities set design criteria for utilities and other public infrastructure. Goochland and Henrico counties and the City of Richmond prohibit manufactured homes in all or portions of the floodplain (respectively). The City of Richmond and Hanover County require manufactured homes to be elevated and anchored. Five of the ordinances describe procedures for structures built before the regulations were in place. Henrico County requires a one-foot freeboard for development in the floodplain.

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**Table VI-7 – Floodplain Regulation Features**

<b>Jurisdiction</b>	<b>Restrict uses</b>	<b>Sets design criteria for utilities</b>	<b>Prohibits manufactured homes in floodplain</b>	<b>Requires manufactured homes to be elevated and/or anchored</b>	<b>Non-conforming structure provisions</b>	<b>Other</b>
<i>Charles City County</i>	✓				✓	
<i>Goochland County</i>	✓	✓	✓			
<i>Hanover County</i>				✓		
<i>Henrico County</i>			✓			One-foot freeboard requirement
<i>New Kent County</i>		✓			✓	
<i>Powhatan County</i>	✓	✓	✓	✓	✓	
<i>City of Richmond</i>		✓	✓	✓	✓	

*Source: Local floodplain ordinances*

### *Other Ordinances*

The State of Virginia encourages local governments to adopt stormwater regulations under land use authorities. Stormwater regulations are most often used to control runoff and erosion potential that results from small scale development of less than 5 acres. Goochland, Hanover, Henrico, and New Kent counties and the City of Richmond have regulations that deal with stormwater management. Charles City and Powhatan counties do not have these types of regulations.

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Virginia also is a signatory to the Chesapeake Bay Agreement, a unique regional partnership aimed at restoration of the Chesapeake Bay. Communities in certain parts of the state are required to implement local land use controls to minimize runoff and other adverse impacts that degrade the water quality of the Bay. Five of the seven jurisdictions in the study area are considered part of the Tidewater area and therefore are required to have a local Bay Act program. These jurisdictions are Charles City, Hanover (including the Town of Ashland), Henrico, New Kent County and the City of Richmond. Goochland and Powhatan counties are not considered to be part of the Tidewater area.

A local Bay Act program has two phases: Phase I program elements include the designation of local Chesapeake Bay Preservation Areas (including Resource Protection Areas and Resource Management Areas that often include floodplains) and adoption of local ordinances that include the required performance criteria. Phase II requires local governments to adopt a comprehensive plan or plan element that addresses the protection of water quality through the discussion of a number of policy areas. Table VI-8 summarizes the status of the Tidewater communities in meeting the two phases of the local program.

<b>Table VI-8 – Chesapeake Bay Act Element Status*</b>		
<b>Jurisdiction</b>	<b>Phase I</b>	<b>Phase II</b>
<i>Town of Ashland</i>	9/27/1999	9/16/2002
<i>Charles City County</i>	3/22/2004	12/2004
<i>Hanover County</i>	6/21/2004	12/11/2000
<i>Henrico County</i>	3/22/2004	6/17/2002
<i>New Kent County</i>	6/21/04 (conditional – compliance deadline of 6/30/2005)	9/18/2000
<i>City of Richmond**</i>	Inconsistent - 3/22/2004 (compliance deadline of 5/15/2004)	9/27/1999
<p><i>*Dates indicates when program was found consistent by state</i></p> <p><i>** New ordinance adopted by the City Council on 12/13/04. Amended ordinance up for consideration by council on 7/25/05.</i></p> <p><i>Source: Virginia Department of Conservation and Recreation, Chesapeake Bay Local Assistance. <a href="http://www.cblad.state.va.us/local_status_contacts.cfm">http://www.cblad.state.va.us/local_status_contacts.cfm</a></i></p>		



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**Building Codes and Building Inspection**

Many structural mitigation measures involve constructing and retrofitting homes, businesses and other structures according to standards designed to make the buildings more resilient to the impacts of natural hazards. Many of these standards are imposed through building codes.

All of the jurisdictions have adopted the Uniform Virginia Building Code. While municipalities and counties may adopt codes for their respective areas if approved by the state as providing “adequate minimum standards,” none of the participating jurisdictions have chosen to do so.

Local governments in Virginia also are empowered to carry out building inspections. The Code of Virginia empowers cities and counties to create an inspection department, and enumerates their duties and responsibilities, which include enforcing state and local laws relating to the construction of buildings, installation of plumbing, electrical, and heating systems; building maintenance; and other matters. Each of the planning jurisdictions have established a Building Inspections Office to carry out its building inspections.

**Fire Codes**

Virginia has a statewide fire code that is enforced by state fire marshals. The code establishes statewide standards to safeguard life and property from the hazards of fire or explosion arising from the improper maintenance of life safety and fire prevention and protection materials, devices, systems and structures. Localities may choose to adopt stricter standards and/or employ their own fire marshals.

Table VI-9 summarizes the various ordinances that are in effect in the jurisdictions in the study area.

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**Table VI-9 — Availability of Ordinances and their Support for Hazard Mitigation**

<i><b>Jurisdiction</b></i>	<i><b>Building Code</b></i>	<i><b>Fire Code</b></i>	<i><b>Floodplain Management Ordinance</b></i>	<i><b>Post-Disaster Reconstruction/ Redevelopment Ordinance</b></i>	<i><b>Subdivision Ordinance</b></i>	<i><b>Unified Development Ordinance</b></i>	<i><b>Zoning Ordinance</b></i>
<i>Charles City County</i>	✓		✓		✓		M
<i>Goochland County</i>	M	M	Part of Zoning		M		H
<i>Hanover County</i>	✓	✓	H	UD	✓	UD	M
<i>Henrico County</i>	✓	✓	H		✓		M
<i>New Kent County</i>	H	H	H/Part of Zoning		H		H
<i>Powhatan County</i>	✓	✓	Part of Zoning		✓		H
<i>City of Richmond</i>	✓	✓	H	UD	✓		M
✓ = Ordinance exists, no assessment of relationship to hazard mitigation H = specifically includes hazard mitigation M = elements could be used to support hazard mitigation L = no mention of hazard mitigation and does not contain elements that would support hazard mitigation or includes elements that would hinder hazard mitigation UD = Under development <i>Source: Capability Assessment Survey Results</i>							

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### **Acquisition**

The power of acquisition can be a useful tool for pursuing local mitigation goals. Local governments may find the most effective method for completely “hazardproofing” a particular piece of property or area is to acquire the property (either in fee simple or a lesser interest, such as an easement), thus removing the property from the private market and eliminating or reducing the possibility of inappropriate development occurring. Virginia legislation empowers cities, towns, and counties to acquire property for public purpose by gift, grant, devise, bequest, exchange, purchase, lease or eminent domain (Code of Virginia 15.2-1901).

The City of Richmond has an open grant application to acquire homes in the Broad Rock Creek area.

### **Taxation**

The power to levy taxes and special assessments is an important tool delegated to local governments by Virginia law. The power of taxation extends beyond merely the collection of revenue, and can have a profound impact on the pattern of development in the community. Communities have the ability through special legislation to set preferential tax rates for areas that are more suitable for development in order to discourage development in otherwise hazardous areas (Code of Virginia 15.3-2404).

Local governments also have the ability to levy special assessments on property owners for all or part of the costs of acquiring, constructing, reconstructing, extending or otherwise building or improving flood protection works within a designated area (Code of Virginia 15.2-1104). This can serve to increase the cost of building in such areas, thereby discouraging development. Because the usual methods of apportionment seem mechanical and arbitrary, and because the tax burden on a particular piece of property is often quite large, the major constraint in using special assessments is policy-oriented. Special assessments seem to offer little in terms of control over land use in developing areas. They can, however, be used to finance the provision of necessary services within municipal or county boundaries. In addition, they are useful in distributing the costs of the infrastructure required by new development to the new property owners.

According to the Code of Virginia 58.1-3389, local governments are authorized to levy taxes on real property with no upper limit imposed. Additionally, Section 58.1-3201 requires that an assessment be 100 percent of fair market value. A building that increases in value over \$500 due to repairs or additions must be assessed as new (Code of Virginia 58.1-3291). At the same time, the code allows the abatement of local real estate taxes for buildings unusable for

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at least 30 days during the year (Code of Virginia 58.1-3222). Real estate tax is a significant source of local revenue.<sup>64</sup>

According to the State Corporation Commission, “the E911 tax is imposed by localities to pay for the cost of an emergency response communications system that identifies both the caller and the location of the call. The tax rate is set by the locality. The General Assembly also authorized a 75¢ per month charge on wireless telephone customers. This money will pay for highly sophisticated equipment that pinpoints, by satellite, the location of a wireless 911 caller.”<sup>65</sup>

Localities in Virginia collect a 1% sales tax. In addition, all of the counties in the study area and the City of Richmond levy property taxes. As noted in Table VI-4, Hanover County and the City of Richmond also use special purpose taxes.

### **Spending**

The fourth major power that has been delegated from the Virginia General Assembly to local governments is the power to make expenditures in the public interest. Hazard mitigation principles should be made a routine part of relevant spending decisions made by the local government, including the adoption of annual budgets and the Capital Improvement Plan (CIP).

A CIP is a schedule for the provision of municipal or county services over a specified period of time. Capital programming, by itself, can be used as a growth management technique, with a view to hazard mitigation. By tentatively committing itself to a timetable for the provision of capital to extend services, a community can control growth to some extent, especially in areas where the provision of on-site sewage disposal and water supply are unusually expensive.

In addition to formulating a timetable for the provision of services, a local community can regulate the extension of and access to services. A CIP that is coordinated with extension and access policies can provide a significant degree of control over the location and timing of growth. These tools can also influence the cost of growth. If the CIP is effective in directing growth away from environmentally sensitive or high hazard areas, for example, it can reduce environmental costs.

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<sup>64</sup> Knapp, John L. and Stephen C. Kulp. *Tax Rates in Virginia's Cities, Counties, & Selected Towns: 2003 Tax Rates*. December 2003. Retrieved from [www.virginia.edu/coopercenter/vastat/taxrates2003/taxrates03.html](http://www.virginia.edu/coopercenter/vastat/taxrates2003/taxrates03.html)

<sup>65</sup> Virginia State Services Corporation Commission. Division of Communications. *Phone Bill Facts*. Retrieved on June 14, 2005 from [www.scc.virginia.gov/division/puc/consumer/bill.htm](http://www.scc.virginia.gov/division/puc/consumer/bill.htm)

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All of the jurisdictions in the planning area have some form of a capital improvements program. The construction or renovation of capital facilities, such as schools, municipal offices, and police/fire stations is often a highlight of their capital improvements program. Investments in stormwater and sewer systems are included in the capital improvements program for most municipalities. Some municipalities also have included open space and other park acquisition costs in the capital improvements program.

### ***Political Capability***

Most residents in the study area are quite knowledgeable about the potential hazards that their community faces, and in recent years, they have become more familiar with the practices and principles of mitigation. Because of this fact, coupled with the Richmond region's recent history with natural disasters, it is expected that the current and future political climates are favorable for supporting and advancing future hazard mitigation strategies. Political willpower to implement hazard mitigation programs should be strong.

In general, several obstacles can make hazard mitigation difficult to implement at the local level. Desirable areas for development, such as waterfront properties, are often also hazardous places to build. Local government must balance the economic benefits and demand for building in such places with the public and private costs that future disasters could inflict. In addition, in areas that are already developed, implementing mitigation actions can be costly. Part of this hazard mitigation plan will be to weigh the costs and benefits of such retrofitting projects to ensure that only those that are cost-effective are chosen.

Hazard mitigation also may not be judged as high a community priority as other projects such as school building or utility improvement. This makes it particularly important to demonstrate how hazard mitigation should be integrated into all community decision-making as opposed to being a stand-alone issue.

One jurisdiction in the planning area noted that "regulation for regulations sake" would not have political support but that the locality will do what it needed to protect life and safety.

### ***Other Capability or Resource Issues***

#### ***Hanover County***

Fire Station #5, the location of the Hanover County Emergency Operations Center, does not have a generator that is capable of producing 100% of the power needed during an electrical outage. The basement of the Hanover County Sheriff's Office is subject to flooding through the windows. This flooding could affect the emergency communications ability of the Sheriff's Office. Emergency communications also is hampered by a lack of interoperability

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between Hanover County and its neighbors. In addition, the far eastern and western portions of the county are communication dead spots. A bond referendum will be held in November 2005 to fund a new radio system.

**Henrico County**

Henrico County runs their own emergency shelters, based on the American Red Cross standards. The county is currently upgrading the power and generator capabilities at their shelters. All other community critical facilities have adequate generator capabilities.

**New Kent County**

New Kent County is the first county within the region encountered by travelers heading west along evacuation routes from the coastal areas. For this reason, county staff believes the county should prepare for approximately 38,000 persons seeking shelter in a hurricane. Road closures also make it difficult for county residents to go to shelters during an event. The county is considering using churches as shelter locations that would allow a network of locations throughout the county.

New Kent County requires all organizations who host large events (e.g., horse races, fairs, ballgames) to provide and utilize National Oceanic and Atmospheric Administration (NOAA) weather radios as a condition of their county permit.

**Powhatan County**

Powhatan County has opened a shelter at the Powhatan Junior High School after ice storms but the shelters received minimal visitors. Approximately 75 people were sheltered at the Powhatan Junior High School during Hurricane Isabel. The county is working with churches throughout the county to develop a dispersed shelter system.

**Summary**

Much of the information in this capability assessment was provided by the jurisdictions in the study area via a capability assessment survey. The last portion of the survey asked the jurisdictions to provide a self-assessment of their capabilities. This section of the plan has provided a more detailed analysis of their capabilities. Table VI-10 summarizes the self-reported capability assessment. The categories used in the survey group are broader than those used to organize this section. *Policy and Program Capability* and *Legal Authority* are combined into *Planning and Regulatory Capability* while *Staff and Organizational Capability* and *Technical Capability* are grouped in the survey as *Administrative and Technical Capability*.

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**Table VI-10 – Capability Self-Assessment**

<i><b>Jurisdiction</b></i>	<i>Planning and Regulatory Capability</i>	<i>Administrative and Technical Capability</i>	<i>Fiscal Capability</i>	<i>Political Capability</i>	<i>Overall Capability</i>
<i>Charles City County</i>	Moderate	High	Limited	Moderate	<b>Moderate</b>
<i>Goochland County</i>	Moderate	Moderate	Moderate	Moderate	<b>Moderate</b>
<i>Hanover County</i>	Moderate	Moderate	Moderate	Moderate	<b>Moderate</b>
<i>Henrico County</i>	High	High	High	High	<b>High</b>
<i>New Kent County</i>	Limited	Moderate	Limited	Moderate	<b>Moderate</b>
<i>Powhatan County</i>	Moderate	Moderate	Limited	Moderate	<b>Moderate</b>
<i>City of Richmond</i>	Moderate	High	Limited	Moderate	<b>Moderate</b>
<p>High: No increase in capability needed (e.g., extensive regulations on development in place)</p> <p>Moderate: Increased capability desired but not needed (e.g., funding exists for mitigation but availability fluctuates)</p> <p>Limited: Increased capability needed (e.g., additional staff are needed to successfully implement mitigation projects)</p> <p><i>Source: Capability Assessment Survey Results</i></p>					

## **Section VII. MITIGATION STRATEGY**

This section of the hazard mitigation plan describes the most challenging part of any such planning effort – the development of a Mitigation Strategy. It is a process of:

1. Setting mitigation goals
2. Considering mitigation alternatives
3. Identifying objectives and strategies
4. Developing a mitigation action plan

### ***Setting Mitigation Goals***

The hazard mitigation planning process followed by the Mitigation Advisory Committee (MAC) is a typical problem-solving methodology:

- Describe the problem (Hazard Identification)
- Estimate the impacts the problem could cause (Vulnerability Assessment)
- Assess what safeguards already exist that might already or could lessen those impacts (Capability Assessment)
- Using the above information, determine what, if anything, can be done and select those actions that are appropriate for the community in question (Develop an Action Plan)

The Action Plan typically consists of three primary components: goals, objectives and strategies. Initially, broad-based goals are developed, which are long-term and general statements. Goals are accomplished by meeting objectives, which are specific and achievable in a finite time period. In many cases, *strategies* are developed and provide a “to do” list to accomplish each objective. When developing the initial goals and objectives for this plan, the Mitigation Advisory Committee was provided with the model on the next page as an example of this relationship.



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<b>GOAL</b> <i>Improve RPPDC Communities' Capabilities To Address Hazard Risks and Vulnerabilities</i>		
<b>Objectives</b>		
<b>Provide Detailed HIRA Data to Communities</b>	<b>Enforce Existing Ordinances</b>	<b>Institutionalize Hazard Mitigation</b>
<b>Strategies</b>		
<ul style="list-style-type: none"><li>• Gather information regarding critical facilities</li><li>• Update floodplain maps and ensure availability in digital format</li></ul>	<ul style="list-style-type: none"><li>• Identify and train floodplain managers</li><li>• Provide funding for additional building inspectors</li><li>• Ensure existing inspectors receive professional certification</li></ul>	<ul style="list-style-type: none"><li>• Dedicate funding for hazard mitigation projects and programs</li><li>• Include hazard mitigation criteria for public facility siting decisions</li></ul>

The Mitigation Advisory Committee discussed goals and objectives for this plan at two points in the planning process. First, the Mitigation Advisory Committee attended a workshop on December 2, 2004, to discuss the results of the hazard identification and risk assessments and begin developing the mitigation strategy by discussing mitigation goals. These goals were broad and applicable to the region. Then, each jurisdiction determined if additional individual goals and objectives were needed.

Strategies were developed as a logical extension of the plan's objectives. Most of these strategies are dynamic and can change. These actions have been organized into a Mitigation Action Plan for the Planning District and its member jurisdictions.

Data collection supports the goals, objectives and recommended strategies in three ways. First, the Hazard Identification/Vulnerability Assessment data identifies:

- Areas exposed to hazards
- At-risk critical facilities
- Future development at risk

For example, this plan recommends that communities determine if existing floodplain ordinances are adequate in preventing hazardous development in the floodplain.

Second, the Capability Assessment data identifies:

- Areas for integration of hazard mitigation into existing policies and plans

For example, this plan recommends that hazard mitigation be included as an element of local comprehensive plans.

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Finally, the Hazard History data identifies:

- Protective measures that could prevent past damages from becoming repetitive

For example, this plan recommends that critical facility audits be instituted to identify facilities that should be considered for mitigation measures.

Representatives from Charles City, Goochland, Hanover, Henrico, New Kent, and Powhatan counties and the City of Richmond used the results of the data collection efforts to develop goals and prioritize strategies for the region and their jurisdiction. The priorities differ somewhat from jurisdiction to jurisdiction. Each jurisdiction's priorities were developed based on past damages, existing exposure to risk, other community goals, and weaknesses identified by the local government capability assessments.

Following the public meeting on April 21, 2005, the following goals for the Richmond Regional Hazard Mitigation Plan were finalized by the Mitigation Advisory Committee. The goals and their associated objectives form the basis for the development of mitigation objectives and individual Action Plans for each jurisdiction and the region.

❖ *Goal 1:*

Reduce damage to public property.

❖ *Goal 2:*

Develop and maintain infrastructure to ensure continued service delivery.

❖ *Goal 3:*

Ensure new development is resilient to natural hazards.

❖ *Goal 4:*

Reduce risk to existing development.

❖ *Goal 5:*

Educate and train our citizens regarding their vulnerability to natural hazards.

❖ *Goal 6:*

Enhance the capabilities of local government to influence and possibly lessen the impact of future disasters.

### ***Considering Mitigation Alternatives***

During the presentation of findings meeting, the Mitigation Advisory Committee reviewed and commented on the draft Plan's Hazard Identification and Risk Assessment. Discussions held during the meeting resulted in the generation of a range of potential mitigation goals

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and objectives to address the hazards. A range of alternatives were then identified and provided to the Mitigation Advisory Committee for consideration. These alternatives are presented in Table VII-2.

The MAC also was provided with a copy of *Tools and Techniques: An Encyclopedia of Strategies to Mitigate the Impacts of Natural Hazards* developed by the State of North Carolina to use as a resource to identify potential mitigation actions.

### **Prioritizing Alternatives**

The Mitigation Advisory Committee used the STAPLE/E Criteria (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) to select and prioritize the most appropriate mitigation alternatives for the Planning District communities. This methodology requires that the social, technical, administrative, political, legal, economic, and environmental considerations be taken into account when reviewing potential actions for the area's jurisdictions to undertake. This process was used to help ensure that the most equitable and feasible actions could be undertaken based on an individual jurisdiction's capabilities.

Table VII-1, on the next page, provides information regarding the review and selection criteria for alternatives.

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**Table VII-1 — STAPLE/E Review And Selection Criteria For Alternatives**

**Social**

- Is the proposed action socially acceptable to the community(s)?
- Are there equity issues involved that would mean that one segment of a community is treated unfairly?
- Will the action cause social disruption?

**Technical**

- Will the proposed action work?
- Will it create more problems than it solves?
- Does it solve a problem or only a symptom?
- Is it the most useful action in light of other community(s) goals?

**Administrative**

- Can the community(s) implement the action?
- Is there someone to coordinate and lead the effort?
- Is there sufficient funding, staff, and technical support available?
- Are there ongoing administrative requirements that need to be met?

**Political**

- Is the action politically acceptable?
- Is there public support both to implement and to maintain the project?

**Legal**

- Is the community(s) authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity?
- Are there legal side effects? Could the activity be construed as a taking?
- Is the proposed action allowed by a comprehensive plan, or must a comprehensive plan be amended to allow the proposed action?
- Will the community(s) be liable for action or lack of action?
- Will the activity be challenged?

**Economic**

- What are the costs and benefits of this action?
- Do the benefits exceed the costs?
- Are initial, maintenance, and administrative costs taken into account?
- Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private)?
- How will this action affect the fiscal capability of the community(s)?

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**Table VII-1 — STAPLE/E Review And Selection Criteria For Alternatives**

- What burden will this action place on the tax base or local economy?
- What are the budget and revenue effects of this activity?
- Does the action contribute to other community goals, such as capital improvements or economic development?
- What benefits will the action provide?

**Environmental**

- How will the action affect the environment?
- Will the action need environmental regulatory approvals?
- Will it meet local and state regulatory requirements?
- Are endangered or threatened species likely to be affected?

*Source: Federal Emergency Management Agency. Developing The Mitigation Plan: Identifying Mitigation Actions And Implementing Strategies (FEMA 386-3)*

Ranking was done in order of relative priority based on the STAPLE/E criteria and the potential goal/action's ability to reduce vulnerability to natural hazards.

### ***Identifying Goals, Objectives and Strategies***

#### **Goals, Objectives, and Strategies**

Through a series of local government workshops and public meetings, the following goals, objectives, and strategies for the Planning District were accepted by the Mitigation Advisory Committee. The goals, objectives, and strategies form the basis for the development of a Mitigation Action Plan and specific mitigation projects to be considered for the Planning District. The process of 1) setting goals, 2) considering mitigation alternatives, and 3) identifying objectives and strategies, and 4) developing an action plan results in a mitigation strategy.

***The Purpose of the Hazard Mitigation Plan***

*To protect the health, safety, and economic security of residents by developing and maintaining communities that are better prepared for natural hazards.*

This overarching purpose statement is intended to clearly state the intent of the participating jurisdictions in participating in this plan. The statement provides a framework in which the goals, objectives, and strategies that follow fit. Community officials should consider the goals that follow in conjunction with community policies, public investment programs, economic development programs, or community development decisions for their communities.

Objectives have been developed for each goal. The objectives state more specific outcomes that the jurisdictions of the Richmond region expect to accomplish over the next five years.

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The objectives provide an overall sense of what exactly is desired, while the strategies will outline the specific steps that can be followed to achieve that end.

❖ **Goal 1: Reduce Damage To Public Property.**

- Objective 1.1: Ensure hazard mitigation principles are considered when siting and designing new public buildings.
  - Strategy 1.1.1: Require new facilities to be sited outside of hazardous areas (e.g., floodplain).
  - Strategy 1.1.2: Incorporate hazard mitigation techniques into new community facilities to minimize damages.
- Objective 1.2: Decrease potential for damage to existing critical facilities from natural hazards.
  - Strategy 1.2.1: Develop comprehensive list of critical facilities.
  - Strategy 1.2.2: Investigate all primary and secondary schools to evaluate their resistance to all natural hazards.
  - Strategy 1.2.3: Investigate all critical community facilities, such as county administrative offices, fire stations and police stations, to evaluate their resistance to flood and wind hazards.

***Future Vision:** Charles City, Goochland, Hanover, Henrico, New Kent, and Powhatan counties and the City of Richmond recognize that government actions often set examples for the rest of the community. The governments, therefore, have committed to ensuring that future public investments promote safe development practices. In addition, local governments have taken steps to ensure that existing public property is made safer from natural disasters.*

❖ **Goal 2: Develop and Maintain Infrastructure to Ensure Continued Service Delivery.**

- Objective 2.1: Ensure emergency or back-up infrastructure is in place.
  - Strategy 2.1.1: Identify need for backup generators, communications and/or vehicles at critical public facilities. Develop means to address shortfalls identified.
  - Strategy 2.1.2: Consider providing necessary electrical hook-up, wiring, and switches to allow readily accessible connections to emergency generators at key critical public facilities.
- Objective 2.2: Minimize disruption to transportation routes during natural disasters.
  - Strategy 2.2.1: Initiate road clearing efforts early in wind and winter storms. Develop plan for quick deployment of road clearing equipment.

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- Strategy 2.2.2: Identify funding opportunities to replace culvert stream crossings with bridges to reduce flood hazards.
- Objective 2.3: Minimize disruption to critical utilities during natural disasters.
  - Strategy 2.3.1: Investigate all utility lines to evaluate their resistance to flood, wind, winter storm hazards.
  - Strategy 2.3.2: Encourage trimming or removal of trees that could down power lines.
  - Strategy 2.3.3: Initiate discussions with private utility companies to discuss incorporating mitigation measures into new and pre-existing development and repairs for infrastructure.
- Objective 2.4: Minimize potential failure of stormwater systems during major storm events.
  - Strategy 2.4.1: Evaluate existing stormwater system to determine if it is adequate for existing (or future) flood hazard.
  - Strategy 2.4.2: Identify program of corrective actions to improve stormwater systems capacity to handle major rain events.
  - Strategy 2.4.3: Conduct a study of the James River floodwall and impact on stormwater system's ability to handle massive rainfall.
  - Strategy 2.4.4: Develop and implement a channel maintenance program consisting of routine inspections and subsequent debris removal to ensure free flow of water in local streams and watercourses.

***Future Vision:** Charles City, Goochland, Hanover, Henrico, New Kent, and Powhatan counties and the City of Richmond have improved their ability to respond, recover, and provide continuity of services in the aftermath of a natural disaster. Critical public facilities continue to be evaluated for their ability to withstand a variety of hazards and are retrofitted as resources have become available. New critical facilities are constructed to allow continuing function after disasters.*

❖ **Goal 3: Ensure New Development is Resilient to Natural Hazards.**

- Objective 3.1: Consider strengthening existing ordinances related to hazard mitigation.
  - Strategy 3.1.1: Review and revise, if needed, the Planning District communities' floodplain ordinances. Work with the state to coordinate a Community Assistance Visit to identify potential improvements or enhancements to existing floodplain management program.

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- Strategy 3.1.2: Evaluate the potential costs versus benefits of implementing a freeboard requirement for all new structures in the 100-year floodplain.
- Strategy 3.1.3: Review and revise, if needed, existing Subdivision Ordinances to include hazard mitigation-related development criteria in order to regulate the location and construction of buildings and other infrastructure in known hazard areas.
- Strategy 3.1.4: Develop a new Zoning Ordinance or revise the existing Zoning Ordinance to include separate zones or districts with appropriate development criteria for known hazard areas.
- Strategy 3.1.5: Include an assessment and associated mapping of the municipalities' vulnerabilities to location-specific hazards and make appropriate recommendations for the use of these hazard areas in the next Comprehensive Plan.
- Objective 3.2: Continue to enforce existing ordinances related to hazard mitigation.
  - Strategy 3.2.1: Continue to enforce zoning and building codes to prevent construction within the flood zone.
  - Strategy 3.2.2: Staff Emergency Management, Building Inspections Office and Zoning Office at adequate levels. (also supports Goal #6)
  - Strategy 3.2.3: Provide training opportunities to county/municipal enforcement staff. (also supports Goal #6)
- Objective 3.3: Educate the building community regarding mitigation techniques and benefits.
  - Strategy 3.3.1: Work with the Home Builders Association of Richmond to integrate mitigation into local continuing education classes for contractors.
- Objective 3.4: Acquire particularly hazardous areas to prevent future development.
  - Strategy 3.4.1: Use fee simple and/or permanent easement to prevent development in the highest priority undeveloped floodplain (and/or wetlands) areas. Use these areas as public open space for passive recreational uses or for utility easements.

***Future Vision:*** Charles City, Goochland, Hanover, Henrico, New Kent, and Powhatan counties and the City of Richmond know that protecting new development is the most cost-effective way to reduce future vulnerability to natural hazards. The communities will continue to implement strong building codes and development guidelines that reduce the risk to future development.



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❖ **Goal 4: Reduce Risk to Existing Development.**

- Objective 4.1: Use existing regulations to require upgrading/retrofitting of existing development.
  - Strategy 4.1.1: Investigate using non-conforming or substantial damage provisions to require hazard retrofitting of existing development.
  - Strategy 4.1.2: Investigate implementation of cumulative damage provisions.
- Objective 4.2: Encourage retrofits of existing development.
  - Strategy 4.2.1: Investigate all manufactured homes and trailers to evaluate their resistance to wind and flood hazards.
  - Strategy 4.2.2: Encourage mobile home parks to identify and publicize nearby shelters for residents.
  - Strategy 4.2.3: Identify existing flood-prone (particularly repetitive loss) structures that may benefit from mitigation measures such as elevation.
  - Strategy 4.2.4: Identify and target an outreach program to industrial facilities (particularly hazardous facilities) to discuss hazards and mitigation alternatives.
  - Strategy 4.2.5: Investigate providing incentives for property owners to implement mitigation measures.
- Objective 4.3: Utilize acquisition or relocation programs to permanently protect properties from flood.
  - Strategy 4.3.1: Evaluate built-upon areas within the flood zone for possible relocation and/or buy-out. In particular, target FEMA's Repetitive Loss Properties throughout the Richmond region for possible relocation and/or buy-out.

***Future Vision:** Charles City, Goochland, Hanover, Henrico, New Kent, and Powhatan counties and the City of Richmond recognize that existing development may be at risk for natural disasters and have taken steps to reduce its vulnerability. The communities have undertaken studies to evaluate the vulnerability of particularly at-risk properties and identified cost-effective mitigation measures.*

❖ **Goal 5: Educate and Train Our Citizens Regarding Their Vulnerability to Natural Hazards.**

- Objective 5.1: Increase public awareness of natural hazards and associated risks.

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- Strategy 5.1.1: Work with local media outlets to increase awareness of natural hazards. Implement seasonal hazard awareness weeks or days (e.g., hurricane preparedness week, winter weather awareness day).
  - Strategy 5.1.2: Work with VDOT to establish flood level markers along bridges and other structures to indicate the rise of water levels along creeks and rivers in potential flood-prone areas.
  - Strategy 5.1.3: Work with the National Weather Service to promote the “Turn Around, Don’t Drown” public education campaign.
  - Strategy 5.1.4: Encourage purchase of NOAA radios by citizens. Provide NOAA weather radios to public facilities.
  - Strategy 5.1.5: Consider participating in the *StormReady* program sponsored by the National Weather Service.
  - Strategy 5.1.6: Increase flood warning capabilities including identification of alternative, safe routes.
  - Strategy 5.1.7: Improve available information regarding flood depths.
- Objective 5.2: Educate citizens on actions to take before, during, and after a natural disaster.
  - Strategy 5.2.1: Partner with Parent Teacher Associations and local schools to implement existing curriculum related to natural hazards (e.g., Masters of Disaster, Risk Watch, CERT).
  - Strategy 5.2.2: Work with local home improvement stores to provide workshops to residents on mitigation techniques.
  - Strategy 5.2.3: Encourage residents to purchase flood insurance and/or sewage back-up insurance. (also helps meet Goal #4)
  - Strategy 5.2.4: Target FEMA’s Repetitive Loss Properties for specialized outreach and mitigation activities.
- Objective 5.3: Educate residents about the natural ecosystems and their relationship to natural hazards.
  - Strategy 5.3.1: Develop and implement a public education program on wetland protection that underscores the functions and values of wetlands. Incorporate information into the program regarding local ordinance provisions that require the identification of wetlands in accordance with federal and state standards and minimize/eliminate their disturbance in accordance with federal and state laws.

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***Future Vision:** As a result of consistent outreach efforts, the citizens, businesses, local officials, and other stakeholders of the Richmond region are more aware of potential community hazards and vulnerable locations. Stakeholders seeking information about hazards and mitigation techniques are able to easily find resources to help them.*

❖ **Goal 6: Enhance the Capabilities of Local Government to Influence and Possibly Lessen the Impact of Future Disasters.**

- Objective 6.1: Increase individual jurisdictions ability to implement hazard mitigation measures.
  - Strategy 6.1.1: Continue the Mitigation Advisory Committee to facilitate coordination and implementation of plan elements, and to help institutionalize and develop an ongoing mitigation program.
  - Strategy 6.1.2: Develop recommendations for revenue sources for mitigation, planning, and projects.
  - Strategy 6.1.3: Incorporate mitigation principles into local comprehensive, emergency management, and recovery plans.
  - Strategy 6.1.4: Evaluate the floodplain manager's roles and responsibilities.
  - Strategy 6.1.5: Consider participating in FEMA's Community Rating System (CRS).
- Objective 6.2: Increase local governments' ability to function in the wake of disaster.
  - Strategy 6.2.1: Develop Continuity of Operations plan.
- Objective 6.3: Improve GIS capabilities and data.
  - Strategy 6.3.1: Develop a detailed building inventory for all structures, in a GIS-based format, which catalogues information regarding assets such as value of structure, contents, age, location (latitude and longitude), etc.
  - Strategy 6.3.2: Identify means to coordinate, collect and store damage assessment data in GIS format for each natural hazard event, which causes death, injury and/or property damage.
  - Strategy 6.3.3: Identify training opportunities for staff to enhance ability to use GIS for emergency management needs.
- Objective 6.4: Increase local governments' ability to prepare for and warn citizens of impending natural hazards.

Strategy 6.4.1: Develop a more advanced flood warning system to increase the ability to locally and specifically forecast flood events and flood depths.

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Partner with other organizations including the National Weather Service, United States Geological Survey and local watershed organizations.

- Strategy 6.4.2: Investigate, develop, or enhance Reverse 911 system or other appropriate emergency communication system for citizens. (also helps meet Goal #5)

***Future Vision:** Hazard mitigation principles have become ingrained in the daily operations of the governments of Charles City, Goochland, Hanover, Henrico, New Kent, and Powhatan counties and the City of Richmond. Additionally, resources have been identified to improve each jurisdiction's technical capabilities and increase their ability to implement viable mitigation projects. The communities have seen a decrease in flood insurance premiums because of their participation in the Community Rating System.*

### **Mitigation Strategies**

In formulating a mitigation strategy, a wide range of activities were considered in order to help achieve the goals and to lessen the vulnerability of the Richmond Regional Planning District area to the effects of natural hazards. The Mitigation Action Plan is comprised of proactive mitigation actions designed to reduce or eliminate future losses from natural hazards in the participating jurisdictions. Table VII-2 shows the full range of mitigation actions considered by the jurisdictions. The table also shows which strategies each jurisdiction identified as appropriate for them. Each jurisdiction also developed strategies that addressed specific needs of that community. These strategies are listed following Table VII-2.

After considering the full list of strategies, jurisdictions prioritized strategies applicable to their individual jurisdictions. The top five to seven strategies for each jurisdiction are further described in the action plans in the next section.

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**Table VII-2 — Mitigation Strategies by Jurisdiction**

Strategy Number	Charles City	Goochland	Hanover	Henrico	New Kent	Powhatan	City of Richmond
1.1.1		X					
1.1.2		X	X		X		
1.2.1						X	X
1.2.2			X			X	X
1.2.3			X				
2.1.1		X	X		X	X	X
2.1.2			X			X	
2.2.1	X						X
2.2.2	X	X	X				
2.3.1			X				
2.3.2		X	X			X	X
2.3.3			X				X
2.4.1			X	X*	X		X

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**Table VII-2 — Mitigation Strategies by Jurisdiction**

Strategy Number	Charles City	Goochland	Hanover	Henrico	New Kent	Powhatan	City of Richmond
2.4.2		X	X				X
2.4.3							X
2.4.4	X		X	X*			X
3.1.1	X		X	X	X	X	
3.1.2	X				X		
3.1.3	X	X	X				
3.1.4	X		X		X		
3.1.5	X	X	X				
3.2.1	X		X	X	X	X	X
3.2.2			X		X		X
3.2.3	X*	X	X			X	X
3.3.1		X	X		X		
3.4.1	X		X	X*	X*		
4.1.1	X						

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**Table VII-2 — Mitigation Strategies by Jurisdiction**

Strategy Number	Charles City	Goochland	Hanover	Henrico	New Kent	Powhatan	City of Richmond
4.1.2			X				
4.2.1					X		
4.2.2			X		X		X
4.2.3			X	X	X		
4.2.4		X	X				X
4.2.5	X		X		X		
4.3.1							X
5.1.1	X	X	X	X*	X	X*	X
5.1.2	X	X	X	X		X	
5.1.3	X	X	X	X?	X	X	X
5.1.4			X				X
5.1.5	X		X	X	X	X	
5.1.6	X	X	X	X*	X		
5.1.7	X	X	X	X	X	X	X

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**Table VII-2 — Mitigation Strategies by Jurisdiction**

Strategy Number	Charles City	Goochland	Hanover	Henrico	New Kent	Powhatan	City of Richmond
5.2.1	X	X		X*	X		X*
5.2.2			X	X*			
5.2.3	X	X	X	X*	X		X
5.2.4				X			
5.3.1	X		X	X*	X*		
6.1.1	X	X	X	X*	X	X	X
6.1.2	X	X	X	X	X		
6.1.3	X*	X	X	X*	X	X	
6.1.4			X		X		X
6.1.5				X	X		X
6.2.1						X	X*
6.3.1	X*		X		X	X	
6.3.2	X*	X	X		X		
6.3.3	X*	X	X		X		X



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**Table VII-2 — Mitigation Strategies by Jurisdiction**

Strategy Number	Charles City	Goochland	Hanover	Henrico	New Kent	Powhatan	City of Richmond
6.4.1	X	X	X		X		X
6.4.2	X*	X*	X	X	X		X
* indicate on-going or in development actions ? indicates action undergoing further consideration							

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### **Strategies by Jurisdiction**

The following section lists the plan's strategies that each jurisdiction determined were appropriate to consider for implementation for that jurisdiction.

#### **Charles City County**

- ❖ Strategy 2.2.1: Initiate road clearing efforts early in wind and winter storms. Develop plan for quick deployment of road clearing equipment.
- ❖ Strategy 2.2.2: Identify funding opportunities to replace culvert stream crossings with bridges to reduce flood hazards.
- ❖ Strategy 2.4.4: Develop and implement a channel maintenance program consisting of routine inspections and subsequent debris removal to ensure free flow of water in local streams and watercourses.
- ❖ Strategy 3.1.1: Review and revise, if needed, the Planning District communities' floodplain ordinances. Work with the state to coordinate a Community Assistance Visit to identify potential improvements or enhancements to existing floodplain management program.
- ❖ Strategy 3.1.2: Evaluate the potential costs versus benefits of implementing a freeboard requirement for all new structures in the 100-year floodplain.
- ❖ Strategy 3.1.3: Review and revise, if needed, existing Subdivision Ordinances to include hazard mitigation-related development criteria in order to regulate the location and construction of buildings and other infrastructure in known hazard areas.
- ❖ Strategy 3.1.4: Develop a new Zoning Ordinance or revise the existing Zoning Ordinance to include separate zones or districts with appropriate development criteria for known hazard areas.
- ❖ Strategy 3.1.5: Include an assessment and associated mapping of the municipalities' vulnerabilities to location-specific hazards and make appropriate recommendations for the use of these hazard areas in the next Comprehensive Plan.
- ❖ Strategy 3.2.1: Continue to enforce zoning and building codes to prevent construction within the flood zone.
- ❖ Strategy 3.2.3: Provide training opportunities to county/municipal enforcement staff.
- ❖ Strategy 3.4.1: Use fee simple and/or permanent easement to prevent development in the highest priority undeveloped floodplain (and/or wetlands) areas. Use these areas as public open space for passive recreational uses or for utility easements.
- ❖ Strategy 4.1.1: Investigate using non-conforming or substantial damage provisions to require hazard retrofitting of existing development.

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- ❖ Strategy 4.2.5: Investigate providing incentives for property owners to implement mitigation measures.
- ❖ Strategy 5.1.1: Work with local media outlets to increase awareness of natural hazards. Implement seasonal hazard awareness weeks or days (e.g., hurricane preparedness week, winter weather awareness day).
- ❖ Strategy 5.1.2: Work with VDOT to establish flood level markers along bridges and other structures to indicate the rise of water levels along creeks and rivers in potential flood-prone areas.
- ❖ Strategy 5.1.3: Work with the National Weather Service to promote the “Turn Around, Don’t Drown” public education campaign.
- ❖ Strategy 5.1.5: Consider participating in the *StormReady* program sponsored by the National Weather Service.
- ❖ Strategy 5.1.6: Increase flood warning capabilities including identification of alternative, safe routes.
- ❖ Strategy 5.1.7: Improve available information regarding flood depths.
- ❖ Strategy 5.2.1: Partner with Parent Teacher Associations and local schools to implement existing curriculum related to natural hazards (e.g., *Masters of Disaster*, *Risk Watch*, CERT).
- ❖ Strategy 5.2.3: Encourage residents to purchase flood insurance and/or sewage back-up insurance.
- ❖ Strategy 5.3.1: Develop and implement a public education program on wetland protections that underscores the functions and values of wetlands. Incorporate information into the program regarding local ordinance provisions that require the identification of wetlands in accordance with federal and state standards and minimize/eliminate their disturbance in accordance with federal and state laws.
- ❖ Strategy 6.1.1: Continue the Mitigation Advisory Committee to facilitate coordination and implementation of plan elements, and to help institutionalize and develop an ongoing mitigation program.
- ❖ Strategy 6.1.2: Develop recommendations for revenue sources for mitigation, planning, and projects.
- ❖ Strategy 6.1.3: Incorporate mitigation principles into local comprehensive, emergency management, and recovery plans.
- ❖ Strategy 6.3.1: Develop a detailed building inventory for all structures, in a GIS-based format, which catalogues information regarding assets such as value of structure, contents, age, location (latitude and longitude), etc.

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- ❖ Strategy 6.3.2: Identify means to coordinate, collect and store damage assessment data in GIS format for each natural hazard event, which causes death, injury and/or property damage.
- ❖ Strategy 6.3.3: Identify training opportunities for staff to enhance ability to use GIS for emergency management needs.
- ❖ Strategy 6.4.1: Develop a more advanced flood warning system to increase the ability to locally and specifically forecast flood events and flood depths. Partner with other organizations including the National Weather Service, United States Geological Survey and local watershed organizations.
- ❖ Strategy 6.4.2: Investigate, develop, or enhance Reverse 911 system or other appropriate emergency communication system for citizens.

During the planning process, staff from the individual jurisdictions identified additional strategies specific to their jurisdictions. The strategies identified by the Charles City County staff follow:

- ❖ Implement FIREWISE wildfire education program.
- ❖ Work with Virginia Dominion Power to educate residents on how to install and hook-up home generators safely. Provide assistance with hook-up on case-by-case basis.

**Goochland**

- ❖ Strategy 1.1.1: Require new facilities to be sited outside of hazardous areas (e.g., floodplain).
- ❖ Strategy 1.1.2: Incorporate hazard mitigation techniques into new community facilities to minimize damages.
- ❖ Strategy 2.1.1: Identify need for backup generators, communications and/or vehicles at critical public facilities. Develop means to address shortfalls identified.
- ❖ Strategy 2.2.2: Identify funding opportunities to replace culvert stream crossings with bridges to reduce flood hazards.
- ❖ Strategy 2.3.2: Encourage trimming or removal of trees that could down power lines.
- ❖ Strategy 2.4.2: Identify program of corrective actions to improve stormwater systems capacity to handle major rain events.
- ❖ Strategy 3.1.3: Review and revise, if needed, existing Subdivision Ordinances to include hazard mitigation-related development criteria in order to regulate the location and construction of buildings and other infrastructure in known hazard areas.

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- ❖ Strategy 3.1.5: Include an assessment and associated mapping of the municipalities' vulnerabilities to location-specific hazards and make appropriate recommendations for the use of these hazard areas in the next Comprehensive Plan.
- ❖ Strategy 3.2.3: Provide training opportunities to county/municipal enforcement staff.
- ❖ Strategy 3.3.1: Work with the Home Builders Association of Richmond to integrate mitigation into local continuing education classes for contractors.
- ❖ Strategy 4.2.4: Identify and target an outreach program to industrial facilities (particularly hazardous facilities) to discuss hazards and mitigation alternatives.
- ❖ Strategy 5.1.1: Work with local media outlets to increase awareness of natural hazards. Implement seasonal hazard awareness weeks or days (e.g., hurricane preparedness week, winter weather awareness day).
- ❖ Strategy 5.1.2: Work with VDOT to establish flood level markers along bridges and other structures to indicate the rise of water levels along creeks and rivers in potential flood-prone areas.
- ❖ Strategy 5.1.3: Work with the National Weather Service to promote the "Turn Around, Don't Drown" public education campaign.
- ❖ Strategy 5.1.6: Increase flood warning capabilities including identification of alternative, safe routes.
- ❖ Strategy 5.1.7: Improve available information regarding flood depths.
- ❖ Strategy 5.2.1: Partner with Parent Teacher Associations and local schools to implement existing curriculum related to natural hazards (e.g., Masters of Disaster, Risk Watch, CERT).
- ❖ Strategy 5.2.3: Encourage residents to purchase flood insurance and/or sewage back-up insurance.
- ❖ Strategy 6.1.1: Continue the Mitigation Advisory Committee to facilitate coordination and implementation of plan elements, and to help institutionalize and develop an ongoing mitigation program.
- ❖ Strategy 6.1.2: Develop recommendations for revenue sources for mitigation, planning, and projects.
- ❖ Strategy 6.1.3: Incorporate mitigation principles into local comprehensive, emergency management, and recovery plans.
- ❖ Strategy 6.3.2: Identify means to coordinate, collect and store damage assessment data in GIS format for each natural hazard event, which causes death, injury and/or property damage.

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- ❖ Strategy 6.3.3: Identify training opportunities for staff to enhance ability to use GIS for emergency management needs.
- ❖ Strategy 6.4.1: Develop a more advanced flood warning system to increase the ability to locally and specifically forecast flood events and flood depths. Partner with other organizations including the National Weather Service, United States Geological Survey and local watershed organizations.
- ❖ Strategy 6.4.2: Investigate, develop, or enhance Reverse 911 system or other appropriate emergency communication system for citizens.

During the planning process, staff from the individual jurisdictions identified additional strategies specific to their jurisdictions. The strategies identified by the Goochland County staff follow:

- ❖ Consider encouraging the use of proffers for road improvements including flood mitigation measures in the next Comprehensive Plan.
- ❖ Coordinate with City of Richmond to address wastewater capacity issues.

#### Hanover

- ❖ Strategy 1.1.2: Incorporate hazard mitigation techniques into new community facilities to minimize damages.
- ❖ Strategy 1.2.2: Investigate all primary and secondary schools to evaluate their resistance to all natural hazards.
- ❖ Strategy 1.2.3: Investigate all critical community facilities, such as county administrative offices, fire stations and police stations, to evaluate their resistance to flood and wind hazards.
- ❖ Strategy 2.1.1: Identify need for backup generators, communications and/or vehicles at critical public facilities. Develop means to address shortfalls identified.
- ❖ Strategy 2.1.2: Consider providing necessary electrical hook-up, wiring, and switches to allow readily accessible connections to emergency generators at key critical public facilities.
- ❖ Strategy 2.2.2: Identify funding opportunities to replace culvert stream crossings with bridges to reduce flood hazards.
- ❖ Strategy 2.3.1: Investigate all utility lines to evaluate their resistance to flood, wind, and winter storm hazards.
- ❖ Strategy 2.3.2: Encourage trimming or removal of trees that could down power lines.

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- ❖ Strategy 2.3.3: Initiate discussions with private utility companies to discuss incorporating mitigation measures into new and pre-existing development and repairs for infrastructure.
- ❖ Strategy 2.4.1: Evaluate existing stormwater system to determine if it is adequate for existing (or future) flood hazard.
- ❖ Strategy 2.4.2: Identify program of corrective actions to improve stormwater systems capacity to handle major rain events.
- ❖ Strategy 2.4.4: Develop and implement a channel maintenance program consisting of routine inspections and subsequent debris removal to ensure free flow of water in local streams and watercourses.
- ❖ Strategy 3.1.1: Review and revise, if needed, the Planning District communities' floodplain ordinances. Work with the state to coordinate a Community Assistance Visit to identify potential improvements or enhancements to existing floodplain management program.
- ❖ Strategy 3.1.3: Review and revise, if needed, existing Subdivision Ordinances to include hazard mitigation-related development criteria in order to regulate the location and construction of buildings and other infrastructure in known hazard areas.
- ❖ Strategy 3.1.4: Develop a new Zoning Ordinance or revise the existing Zoning Ordinance to include separate zones or districts with appropriate development criteria for known hazard areas.
- ❖ Strategy 3.1.5: Include an assessment and associated mapping of the municipalities' vulnerabilities to location-specific hazards and make appropriate recommendations for the use of these hazard areas in the next Comprehensive Plan.
- ❖ Strategy 3.2.1: Continue to enforce zoning and building codes to prevent construction within the flood zone.
- ❖ Strategy 3.2.2: Staff Emergency Management, Building Inspections Office and Zoning Office at adequate levels. (also supports Goal #6)
- ❖ Strategy 3.2.3: Provide training opportunities to county/municipal enforcement staff.
- ❖ Strategy 3.3.1: Work with the Home Builders Association of Richmond to integrate mitigation into local continuing education classes for contractors.
- ❖ Strategy 3.4.1: Use fee simple and/or permanent easement to prevent development in the highest priority undeveloped floodplain (and/or wetlands) areas. Use these areas as public open space for passive recreational uses or for utility easements.
- ❖ Strategy 4.1.2: Investigate implementation of cumulative damage provisions.

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- ❖ Strategy 4.2.2: Encourage mobile home parks to identify and publicize nearby shelters for residents.
- ❖ Strategy 4.2.3: Identify existing flood-prone structures that may benefit from mitigation measures such as elevation.
- ❖ Strategy 4.2.4: Identify and target an outreach program to industrial facilities (particularly hazardous facilities) to discuss hazards and mitigation alternatives.
- ❖ Strategy 4.2.5: Investigate providing incentives for property owners to implement mitigation measures.
- ❖ Strategy 5.1.1: Work with local media outlets to increase awareness of natural hazards. Implement seasonal hazard awareness weeks or days (e.g., hurricane preparedness week, winter weather awareness day).
- ❖ Strategy 5.1.2: Work with VDOT to establish flood level markers along bridges and other structures to indicate the rise of water levels along creeks and rivers in potential flood-prone areas.
- ❖ Strategy 5.1.3: Work with the National Weather Service to promote the “Turn Around, Don’t Drown” public education campaign.
- ❖ Strategy 5.1.4: Encourage purchase of NOAA radios by citizens. Provide NOAA weather radios to public facilities.
- ❖ Strategy 5.1.5: Consider participating in the *StormReady* program sponsored by the National Weather Service.
- ❖ Strategy 5.1.6: Increase flood warning capabilities including identification of alternative, safe routes.
- ❖ Strategy 5.1.7: Improve available information regarding flood depths.
- ❖ Strategy 5.2.2: Work with local home improvement stores to provide workshops to residents on mitigation techniques.
- ❖ Strategy 5.2.3: Encourage residents to purchase flood insurance and/or sewage back-up insurance.
- ❖ Strategy 5.3.1: Develop and implement a public education program on wetland protections that underscores the functions and values of wetlands. Incorporate information into the program regarding local ordinance provisions that require the identification of wetlands in accordance with federal and state standards and minimize/eliminate their disturbance in accordance with federal and state laws.



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- ❖ Strategy 6.1.1: Continue the Mitigation Advisory Committee to facilitate coordination and implementation of plan elements, and to help institutionalize and develop an ongoing mitigation program.
- ❖ Strategy 6.1.2: Develop recommendations for revenue sources for mitigation, planning, and projects.
- ❖ Strategy 6.1.3: Incorporate mitigation principles into local comprehensive, emergency management, and recovery plans.
- ❖ Strategy 6.1.4: Evaluate the floodplain manager's roles and responsibilities.
- ❖ Strategy 6.3.1: Develop a detailed building inventory for all structures, in a GIS-based format, which catalogues information regarding assets such as value of structure, contents, age, location (latitude and longitude), etc.
- ❖ Strategy 6.3.2: Identify means to coordinate, collect and store damage assessment data in GIS format for each natural hazard event, which causes death, injury and/or property damage.
- ❖ Strategy 6.3.3: Identify training opportunities for staff to enhance ability to use GIS for emergency management needs.
- ❖ Strategy 6.4.1: Develop a more advanced flood warning system to increase the ability to locally and specifically forecast flood events and flood depths. Partner with other organizations including the National Weather Service, United States Geological Survey and local watershed organizations.
- ❖ Strategy 6.4.2: Investigate, develop, or enhance Reverse 911 system or other appropriate emergency communication system for citizens.

During the planning process, staff from the individual jurisdictions identified additional strategies specific to their jurisdictions. The strategies identified by the Hanover County staff follow:

- ❖ Increase interoperability of communication systems with other jurisdictions.
- ❖ Design and install storm sewer at Gardner Estates to prevent flooding of residential structures.

#### Henrico

- ❖ Strategy 2.4.1: Evaluate existing stormwater system to determine if it is adequate for existing (or future) flood hazard.
- ❖ Strategy 2.4.4: Develop and implement a channel maintenance program consisting of routine inspections and subsequent debris removal to ensure free flow of water in local streams and watercourses.

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- ❖ Strategy 3.1.1: Review and revise, if needed, the Planning District communities' floodplain ordinances. Work with the state to coordinate a Community Assistance Visit to identify potential improvements or enhancements to existing floodplain management program.
- ❖ Strategy 3.2.1: Continue to enforce zoning and building codes to prevent construction within the flood zone.
- ❖ Strategy 3.4.1: Use fee simple and/or permanent easement to prevent development in the highest priority undeveloped floodplain (and/or wetlands) areas. Use these areas as public open space for passive recreational uses or for utility easements.
- ❖ Strategy 4.2.3: Identify existing flood-prone structures that may benefit from mitigation measures such as elevation.
- ❖ Strategy 5.1.1: Work with local media outlets to increase awareness of natural hazards. Implement seasonal hazard awareness weeks or days (e.g., hurricane preparedness week, winter weather awareness day).
- ❖ Strategy 5.1.2: Work with VDOT to establish flood level markers along bridges and other structures to indicate the rise of water levels along creeks and rivers in potential flood-prone areas.
- ❖ Strategy 5.1.3: Work with the National Weather Service to promote the "Turn Around, Don't Drown" public education campaign.
- ❖ Strategy 5.1.5: Consider participating in the *StormReady* program sponsored by the National Weather Service.
- ❖ Strategy 5.1.6: Increase flood warning capabilities including identification of alternative, safe routes.
- ❖ Strategy 5.1.7: Improve available information regarding flood depths.
- ❖ Strategy 5.2.1: Partner with Parent Teacher Associations and local schools to implement existing curriculum related to natural hazards (e.g., Masters of Disaster, Risk Watch, CERT).
- ❖ Strategy 5.2.2: Work with local home improvement stores to provide workshops to residents on mitigation techniques.
- ❖ Strategy 5.2.3: Encourage residents to purchase flood insurance and/or sewage back-up insurance.
- ❖ Strategy 5.2.4: Target FEMA's Repetitive Loss Properties for specialized outreach and mitigation activities.

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- ❖ Strategy 5.3.1: Develop and implement a public education program on wetland protections that underscores the functions and values of wetlands. Incorporate information into the program regarding local ordinance provisions that require the identification of wetlands in accordance with federal and state standards and minimize/eliminate their disturbance in accordance with federal and state laws.
- ❖ Strategy 6.1.1: Continue the Mitigation Advisory Committee to facilitate coordination and implementation of plan elements, and to help institutionalize and develop an ongoing mitigation program.
- ❖ Strategy 6.1.2: Develop recommendations for revenue sources for mitigation, planning, and projects.
- ❖ Strategy 6.1.3: Incorporate mitigation principles into local comprehensive, emergency management, and recovery plans.
- ❖ Strategy 6.1.5: Consider participating in FEMA's Community Rating System (CRS).
- ❖ Strategy 6.4.2: Investigate, develop, or enhance Reverse 911 system or other appropriate emergency communication system for citizens.

During the planning process, staff from the individual jurisdictions identified additional strategies specific to their jurisdictions. The strategies identified by the Henrico County staff follow:

- ❖ Promote education of citizens concerning home fuel tanks and need for upgrading and/or anchoring such systems (reference problems during Tropical Storm Gaston).
- ❖ Continue enforcement of County's erosion and sediment control ordinance as means to reduce conditions that lead to landslides or slope failures.

**New Kent**

- ❖ Strategy 1.1.2: Incorporate hazard mitigation techniques into new community facilities to minimize damages.
- ❖ Strategy 2.1.1: Identify need for backup generators, communications and/or vehicles at critical public facilities. Develop means to address shortfalls identified.
- ❖ Strategy 2.4.1: Evaluate existing stormwater system to determine if it is adequate for existing (or future) flood hazard.
- ❖ Strategy 3.1.1: Review and revise, if needed, the Planning District communities' floodplain ordinances. Work with the state to coordinate a Community Assistance Visit to identify potential improvements or enhancements to existing floodplain management program.

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- ❖ Strategy 3.1.2: Evaluate the potential costs versus benefits of implementing a freeboard requirement for all new structures in the 100-year floodplain.
- ❖ Strategy 3.1.4: Develop a new Zoning Ordinance or revise the existing Zoning Ordinance to include separate zones or districts with appropriate development criteria for known hazard areas.
- ❖ Strategy 3.2.1: Continue to enforce zoning and building codes to prevent construction within the flood zone.
- ❖ Strategy 3.2.2: Staff Emergency Management, Building Inspections Office and Zoning Office at adequate levels. (also supports Goal #6)
- ❖ Strategy 3.3.1: Work with the Home Builders Association of Richmond to integrate mitigation into local continuing education classes for contractors.
- ❖ Strategy 3.4.1: Use fee simple and/or permanent easement to prevent development in the highest priority undeveloped floodplain (and/or wetlands) areas. Use these areas as public open space for passive recreational uses or for utility easements.
- ❖ Strategy 4.2.1: Investigate all manufactured homes and trailers to evaluate their resistance to wind and flood hazards.
- ❖ Strategy 4.2.2: Encourage mobile home parks to identify and publicize nearby shelters for residents.
- ❖ Strategy 4.2.3: Identify existing flood-prone structures that may benefit from mitigation measures such as elevation.
- ❖ Strategy 4.2.5: Investigate providing incentives for property owners to implement mitigation measures.
- ❖ Strategy 5.1.1: Work with local media outlets to increase awareness of natural hazards. Implement seasonal hazard awareness weeks or days (e.g., hurricane preparedness week, winter weather awareness day).
- ❖ Strategy 5.1.3: Work with the National Weather Service to promote the “Turn Around, Don’t Drown” public education campaign.
- ❖ Strategy 5.1.5: Consider participating in the *StormReady* program sponsored by the National Weather Service.
- ❖ Strategy 5.1.6: Increase flood warning capabilities including identification of alternative, safe routes.
- ❖ Strategy 5.1.7: Improve available information regarding flood depths.

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- ❖ Strategy 5.2.1: Partner with Parent Teacher Associations and local schools to implement existing curriculum related to natural hazards (e.g., Masters of Disaster, Risk Watch, CERT).
- ❖ Strategy 5.2.3: Encourage residents to purchase flood insurance and/or sewage back-up insurance.
- ❖ Strategy 5.3.1: Develop and implement a public education program on wetland protections that underscores the functions and values of wetlands. Incorporate information into the program regarding local ordinance provisions that require the identification of wetlands in accordance with federal and state standards and minimize/eliminate their disturbance in accordance with federal and state laws.
- ❖ Strategy 6.1.1: Continue the Mitigation Advisory Committee to facilitate coordination and implementation of plan elements, and to help institutionalize and develop an ongoing mitigation program.
- ❖ Strategy 6.1.2: Develop recommendations for revenue sources for mitigation, planning, and projects.
- ❖ Strategy 6.1.3: Incorporate mitigation principles into local comprehensive, emergency management, and recovery plans.
- ❖ Strategy 6.1.4: Evaluate the floodplain manager's roles and responsibilities.
- ❖ Strategy 6.1.5: Consider participating in FEMA's Community Rating System (CRS).
- ❖ Strategy 6.3.1: Develop a detailed building inventory for all structures, in a GIS-based format, which catalogues information regarding assets such as value of structure, contents, age, location (latitude and longitude), etc.
- ❖ Strategy 6.3.2: Identify means to coordinate, collect and store damage assessment data in GIS format for each natural hazard event, which causes death, injury and/or property damage.
- ❖ Strategy 6.3.3: Identify training opportunities for staff to enhance ability to use GIS for emergency management needs.
- ❖ Strategy 6.4.1: Develop a more advanced flood warning system to increase the ability to locally and specifically forecast flood events and flood depths. Partner with other organizations including the National Weather Service, United States Geological Survey and local watershed organizations.
- ❖ Strategy 6.4.2: Investigate, develop, or enhance Reverse 911 system or other appropriate emergency communication system for citizens.

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During the planning process, staff from the individual jurisdictions identified additional strategies specific to their jurisdictions. The strategies identified by the New Kent County staff follow:

- ❖ Elevate or pursue other floodproofing of road in Fannies Creek area.
- ❖ Pursue looped electrical grid for eastern part of county.
- ❖ Work with the Virginia Department of Forestry to implement the FIREWISE program in New Kent County.

**Powhatan**

- ❖ Strategy 1.2.1: Develop comprehensive list of critical facilities.
- ❖ Strategy 1.2.2: Investigate all primary and secondary schools to evaluate their resistance to all natural hazards.
- ❖ Strategy 2.1.1: Identify need for backup generators, communications and/or vehicles at critical public facilities. Develop means to address shortfalls identified.
- ❖ Strategy 2.1.2: Consider providing necessary electrical hook-up, wiring, and switches to allow readily accessible connections to emergency generators at key critical public facilities.
- ❖ Strategy 2.3.2: Encourage trimming or removal of trees that could down power lines.
- ❖ Strategy 3.1.1: Review and revise, if needed, the Planning District communities' floodplain ordinances. Work with the state to coordinate a Community Assistance Visit to identify potential improvements or enhancements to existing floodplain management program.
- ❖ Strategy 3.2.1: Continue to enforce zoning and building codes to prevent construction within the flood zone.
- ❖ Strategy 3.2.3: Provide training opportunities to county/municipal enforcement staff.
- ❖ Strategy 5.1.1: Work with local media outlets to increase awareness of natural hazards. Implement seasonal hazard awareness weeks or days (e.g., hurricane preparedness week, winter weather awareness day).
- ❖ Strategy 5.1.2: Work with VDOT to establish flood level markers along bridges and other structures to indicate the rise of water levels along creeks and rivers in potential flood-prone areas.
- ❖ Strategy 5.1.3: Work with the National Weather Service to promote the "Turn Around, Don't Drown" public education campaign.
- ❖ Strategy 5.1.5: Consider participating in the *StormReady* program sponsored by the National Weather Service.

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- ❖ Strategy 5.1.7: Improve available information regarding flood depths.
- ❖ Strategy 6.1.1: Continue the Mitigation Advisory Committee to facilitate coordination and implementation of plan elements, and to help institutionalize and develop an ongoing mitigation program.
- ❖ Strategy 6.1.3: Incorporate mitigation principles into local comprehensive, emergency management, and recovery plans.
- ❖ Strategy 6.2.1: Develop Continuity of Operations plan.
- ❖ Strategy 6.3.1: Develop a detailed building inventory for all structures, in a GIS-based format, which catalogues information regarding assets such as value of structure, contents, age, location (latitude and longitude), etc.

During the planning process, staff from the individual jurisdictions identified additional strategies specific to their jurisdictions. The strategies identified by the Powhatan County staff follow:

- ❖ Investigate requiring two means of access to new subdivisions.
- ❖ Educate residents about shelter availability.

*City of Richmond*

- ❖ Strategy 1.2.1: Develop comprehensive list of critical facilities.
- ❖ Strategy 1.2.2: Investigate all primary and secondary schools to evaluate their resistance to all natural hazards.
- ❖ Strategy 2.1.1: Identify need for backup generators, communications and/or vehicles at critical public facilities. Develop means to address shortfalls identified.
- ❖ Strategy 2.2.1: Initiate road clearing efforts early in wind and winter storms. Develop plan for quick deployment of road clearing equipment.
- ❖ Strategy 2.3.2: Encourage trimming or removal of trees that could down power lines.
- ❖ Strategy 2.3.3: Initiate discussions with private utility companies to discuss incorporating mitigation measures into new and pre-existing development and repairs for infrastructure.
- ❖ Strategy 2.4.1: Evaluate existing stormwater system to determine if it is adequate for existing (or future) flood hazard.
- ❖ Strategy 2.4.2: Identify program of corrective actions to improve stormwater systems capacity to handle major rain events.
- ❖ Strategy 2.4.3: Conduct a study of the James River floodwall and impact on stormwater system's ability to handle massive rainfall.

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- ❖ Strategy 2.4.4: Develop and implement a channel maintenance program consisting of routine inspections and subsequent debris removal to ensure free flow of water in local streams and watercourses.
- ❖ Strategy 3.2.1: Continue to enforce zoning and building codes to prevent construction within the flood zone.
- ❖ Strategy 3.2.2: Staff Emergency Management, Building Inspections Office and Zoning Office at adequate levels. (also supports Goal #6)
- ❖ Strategy 3.2.3: Provide training opportunities to county/municipal enforcement staff.
- ❖ Strategy 4.2.2: Encourage mobile home parks to identify and publicize nearby shelters for residents.
- ❖ Strategy 4.2.4: Identify and target an outreach program to industrial facilities (particularly hazardous facilities) to discuss hazards and mitigation alternatives.
- ❖ Strategy 4.3.1: Evaluate built-upon areas within the flood zone for possible relocation and/or buy-out. In particular, target FEMA's Repetitive Loss Properties throughout the Richmond region for possible relocation and/or buy-out.
- ❖ Strategy 5.1.1: Work with local media outlets to increase awareness of natural hazards. Implement seasonal hazard awareness weeks or days (e.g., hurricane preparedness week, winter weather awareness day).
- ❖ Strategy 5.1.3: Work with the National Weather Service to promote the "Turn Around, Don't Drown" public education campaign.
- ❖ Strategy 5.1.4: Encourage purchase of NOAA radios by citizens. Provide NOAA weather radios to public facilities.
- ❖ Strategy 5.1.7: Improve available information regarding flood depths.
- ❖ Strategy 5.2.1: Partner with Parent Teacher Associations and local schools to implement existing curriculum related to natural hazards (e.g., Masters of Disaster, Risk Watch, CERT).
- ❖ Strategy 5.2.3: Encourage residents to purchase flood insurance and/or sewage back-up insurance.
- ❖ Strategy 6.1.1: Continue the Mitigation Advisory Committee to facilitate coordination and implementation of plan elements, and to help institutionalize and develop an ongoing mitigation program.
- ❖ Strategy 6.1.4: Evaluate the floodplain manager's roles and responsibilities.
- ❖ Strategy 6.1.5: Consider participating in FEMA's Community Rating System (CRS).
- ❖ Strategy 6.2.1: Develop Continuity of Operations plan.



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- ❖ Strategy 6.3.3: Identify training opportunities for staff to enhance ability to use GIS for emergency management needs.
- ❖ Strategy 6.4.1: Develop a more advanced flood warning system to increase the ability to locally and specifically forecast flood events and flood depths. Partner with other organizations including the National Weather Service, United States Geological Survey and local watershed organizations.
- ❖ Strategy 6.4.2: Investigate, develop, or enhance Reverse 911 system or other appropriate emergency communication system for citizens.

During the planning process, staff from the individual jurisdictions identified additional strategies specific to their jurisdictions. The strategies identified by the City of Richmond staff follow:

- ❖ Conduct an in-depth study of the need and feasibility of stabilizing Government Road to prevent damage from future landslides.
- ❖ Enhance development or understanding of statewide mutual aid agreements for use in post-disaster building inspections.
- ❖ Pursue dedicated funding stream for emergency storm program.
- ❖ Expand existing warning system to include schools.
- ❖ Conduct an in-depth earthquake vulnerability assessment study.
- ❖ Work with the Red Cross to credential new shelters south of the river.

**Town of Ashland**

- ❖ Strategy 1.1.1: Require new facilities to be sited outside of hazardous areas (e.g., floodplain).
- ❖ Strategy 1.1.2: Incorporate hazard mitigation techniques into new community facilities to minimize damages.
- ❖ Strategy 1.2.1: Develop comprehensive list of critical facilities.
- ❖ Strategy 2.1.1: Identify need for backup generators, communications and/or vehicles at critical public facilities. Develop means to address shortfall identified. Currently pursuing generators for Town Hall.
- ❖ Strategy 2.3.2: Encourage trimming or removal of trees that could down power lines. [on-going]
- ❖ Strategy 2.3.3: Continue discussions with private utility companies to discuss incorporating mitigation measures into new and pre-existing development and repairs for infrastructure. [on-going]

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- ❖ Strategy 2.4.1: Evaluate existing stormwater system to determine if it is adequate for existing (or future) flood hazard. [on-going]
- ❖ Strategy 2.4.2: Identify program of corrective actions to improve stormwater systems capacity to handle major rain events. [on-going]
- ❖ Strategy 2.4.4: Develop and implement a channel maintenance program consisting of routine inspections and subsequent debris removal to ensure free flow of water in local streams and watercourses. [on-going]
- ❖ Strategy 3.1.1: Review and revise, if needed, the Planning District communities' floodplain ordinances. Work with the state to coordinate a Community Assistance Visit to identify potential improvements or enhancements to existing floodplain management program.
- ❖ Strategy 3.1.2: Evaluate the potential costs versus benefits of implementing a freeboard requirement for all new structures in the 100-year floodplain.
- ❖ Strategy 3.1.3: Review and revise, if needed, existing Subdivision Ordinances to include hazard mitigation-related development criteria in order to regulate the location and construction of buildings and other infrastructure in known hazard areas. [on-going]
- ❖ Strategy 3.1.4: Develop a new Zoning Ordinance or revise the existing Zoning Ordinance to include separate zones or districts with appropriate development criteria for known hazard areas. [on-going]
- ❖ Strategy 3.1.5: Include an assessment and associated mapping of the municipalities' vulnerabilities to location-specific hazards and make appropriate recommendations for the use of these hazard areas in the next Comprehensive Plan. [on-going]
- ❖ Strategy 3.2.1: Continue to enforce zoning and building codes to prevent construction within the flood zone. [on-going]
- ❖ Strategy 3.4.1: Use fee simple and/or permanent easement to prevent development in the highest priority undeveloped floodplain (and/or wetlands) areas. Use these areas as public open space for passive recreational uses. [on-going]
- ❖ Strategy 4.1.1: Investigate using non-conforming or substantial damage provisions to require hazard retrofitting of existing development. [on-going]
- ❖ Strategy 4.1.2: Investigate implementation of cumulative damage provision as part of floodplain ordinance.
- ❖ Strategy 4.2.3: Identify existing flood-prone structures that may benefit from mitigation measures such as elevation.

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- ❖ Strategy 4.3.1: Evaluate built-upon areas within the flood zone for possible relocation and/or buy-out. In particular, target FEMA’s Repetitive Loss Properties throughout the Richmond region for possible relocation and/or buy-out.
- ❖ Strategy 5.1.1: Work with local media outlets to increase awareness of natural hazards. Implement seasonal hazard awareness weeks or days (e.g., hurricane preparedness week, winter weather awareness day). Attempt to address this at a regional level.
- ❖ Strategy 5.1.3: Work with the National Weather Service to promote the “Turn Around, Don’t Drown” public education campaign.
- ❖ Strategy 5.1.4: Encourage purchase of NOAA radios. Provide NOAA weather radios to public facilities.
- ❖ Strategy 5.1.5: Consider participating in the *StormReady* program sponsored by the National Weather Service.
- ❖ Strategy 5.1.6: Increase flood warning capabilities including identification of alternative, safe routes. Work with Hanover County and VDOT.
- ❖ Strategy 5.2.3: Promote the purchase of flood insurance and/or sewer back-up insurance. [on-going]
- ❖ Strategy 6.1.1: Continue the Mitigation Advisory Committee to facilitate coordination and implementation of plan elements, and to help institutionalize and develop an on-going mitigation program.
- ❖ Strategy 6.1.2: Develop recommendations for revenue sources for mitigation, planning, and projects.
- ❖ Strategy 6.1.3: Incorporate mitigation principles into local comprehensive, emergency management, and recovery plans. Need to update EOP.
- ❖ Strategy 6.1.4: Evaluate the floodplain manager’s roles and responsibilities.
- ❖ Strategy 6.1.5: Consider participating in FEMA’s Community Rating System (CRS).
- ❖ Strategy 6.2.1: Develop a Continuity of Operations Plan.
- ❖ Strategy 6.3.3: Identify training opportunities for staff to enhance ability to use GIS for emergency management needs.
- ❖ Strategy 6.4.1: Develop a more advanced flood warning system to increase the ability to locally and specifically forecast flood events and flood depths. Partner with other organizations including the National Weather Service, United States Geological Survey and local watershed organizations. Coordinate with Hanover County.

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- ❖ Strategy 6.4.2: Investigate, develop, or enhance Reverse 911 system or other appropriate emergency communication system for citizens. Look into this as joint venture with County.

During the planning process, staff from the individual jurisdictions identified additional strategies specific to their jurisdictions. The strategies identified by the Charles City staff follow:

- ❖ Identify an emergency shelter within the Town limits.
- ❖ Continue to look for opportunities to work with Randolph Macon College on hazard mitigation planning.
- ❖ Update and digitize community Flood Insurance Rate Maps (FIRMs).

### ***Developing a Mitigation Action Plan***

A mitigation action plan has been developed for the region and for each individual jurisdiction. The strategies have been designed to achieve the goals and objectives identified in this multi-jurisdictional all-hazards mitigation plan. Each proposed strategy includes:

- (1) the appropriate category for the mitigation technique
- (2) the hazard it is designed to mitigate
- (3) the objective(s) it is intended to help achieve
- (4) general background information
- (5) the priority level for its implementation (high, moderate, or low)
- (6) potential funding sources, if applicable
- (7) the agency/person assigned responsibility for carrying out the strategy
- (8) a target completion date

When formulating a Mitigation Action Plan, a wide range of activities should be considered to help achieve the goals of communities and lessen the vulnerability of the participating jurisdictions to the effects of natural hazards. In general, all of these activities fall into one of the following broad categories of mitigation techniques. Appendix H includes the range of alternatives that were considered by the Mitigation Advisory Committee and an explanation of the broad categories.

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## **Regional Actions**

The strategies on the following pages are ones that can be undertaken as a regional effort. Together, these comprise a regional action plan.

<b>Strategy #5.1.1:</b> Work with local media outlets to increase awareness of natural hazards. Implement seasonal hazard awareness weeks or days (e.g., hurricane preparedness week, winter weather awareness day).	
Affected Jurisdictions	All
Category	Public Information and Awareness
Hazard	All Hazards
Objective(s) addressed	5.1
Background	<p>A 2004 study sponsored by the American Red Cross and Wirthlin, a survey research firm, found that while Americans recognize the importance of being personally prepared for disaster, fewer than two in ten U.S. adults characterize themselves as very prepared.</p> <p>For people to take the steps to become prepared for disaster, they first must be aware of their risk. Media outlets (e.g., television, radio, print) can play an important role in raising awareness and encouraging personal responsibility to minimize the loss of life and property during a disaster.</p> <p>Public education campaigns can be tied to specific events (e.g., anniversary of a disaster) or to a particular hazard and time of year (e.g., hurricane preparedness week in the early summer).</p>
Priority	Medium
Funding sources	FEMA (HMGP 5% funds), VDEM, local government operating budgets, private sources
Responsible party	Mitigation Advisory Committee; County/City Public Information Officer
Completion date	On-going

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<b>Strategy #5.1.3:</b> Work with the Wakefield office of the National Weather Service to promote the “Turn Around, Don’t Drown” public education campaign.	
Affected Jurisdictions	All
Category	Public Information and Awareness
Hazard	Flood
Objective(s) addressed	5.1
Background	<p>Flooding causes more deaths than any other severe weather related hazard. Many of the deaths occur in automobiles as they are swept away by floodwaters. The Richmond region has seen its share of driver and passenger fatalities.</p> <p>The National Weather Service has developed a public education campaign, “Turn Around, Don’t Drown,” to educate drivers about the hazards flood waters pose.</p> <p>A range of public education materials, such as brochures, signs, and Public Service Announcements, already have been developed by the National Weather Service for use by its local office and local government.</p>
Priority	High
Funding sources	National Weather Service
Responsible party	Mitigation Advisory Committee; Richmond Regional Planning District Commission; County/City Public Information Officer
Completion date	Six months after plan approval

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<b>Strategy #5.1.7: Improve available information regarding flood depths.</b>	
Affected Jurisdictions	All
Category	N/A
Hazard	Flood
Objective(s) addressed	5.1
Background	<p>A flood loss estimate was not performed for the Regional Hazard Mitigation Plan because information on flood depths was unavailable.</p> <p>The Mitigation Advisory Committee should work with FEMA and VDEM to determine flood depths and make available in a GIS format. This could include collecting first floor elevations for structures in specific flood prone areas, cataloguing elevation certificates, and performing localized flood studies.</p>
Priority	Medium
Funding sources	FEMA, VDEM, local government operating budgets
Responsible party	FEMA, VDEM, Mitigation Advisory Committee
Completion date	On-going

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<b>Strategy #5.2.3:</b> Encourage residents to purchase flood insurance and/or sewage back-up insurance.	
Affected Jurisdictions	All
Category	Public Information and Awareness
Hazard	Flood
Objective(s) addressed	5.2
Background	<p>Damage from flooding is not covered by homeowner's or renter's insurance policies. A specific flood insurance policy must be purchased. Flood insurance is required for homes in the floodplain if there is a federally-backed mortgage on the property.</p> <p>Public education about flood insurance is necessary for several reasons. Homeowners may allow policies to lapse, such as after a mortgage is paid off. In addition, homeowners may be at risk to flooding even if their home is not located in a FEMA-mapped floodplain. A public education campaign regarding flood insurance has been recognized as a national priority for FEMA.</p> <p>In addition, damages from sewer back-up or overflow are not covered by homeowner's or renter's insurance policies. Sewer back-up insurance can be purchased as a rider to a regular homeowner's or renter's policy. Generally, this increased coverage is inexpensive.</p>
Priority	Medium
Funding sources	FEMA/Flood Insurance and Mitigation Administration
Responsible party	Mitigation Advisory Committee; Richmond Regional Planning District Commission; County/City Public Information Officer
Completion date	Six months after plan approval



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<b>Strategy #6.1.1:</b> Continue the Mitigation Advisory Committee to facilitate coordination and implementation of plan elements, and to help institutionalize and develop an ongoing mitigation program.	
Affected Jurisdictions	All
Category	N/A
Hazard	All Hazards
Objective(s) addressed	6.1
Background	<p>The Disaster Mitigation Act of 2000 (DMA2K) required local governments to develop and to adopt all hazards mitigation plans to be eligible for certain types of future disaster assistance including funds for mitigation activities.</p> <p>The Richmond Regional PDC formed a multi-jurisdictional committee to oversee hazard mitigation planning efforts for the Richmond region. Each participating jurisdictions were represented on the committee.</p> <p>One way to increase the effectiveness of such a committee and ensure long-term plan implementation is to grant them official status. In addition, a formalized committee will be of assistance by allowing communities to share the workload when implementing regional activities.</p>
Priority	High
Funding sources	N/A
Responsible party	Mitigation Advisory Committee; Richmond Regional Planning District Commission
Completion date	Immediately following plan approval

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### **Multi-jurisdictional Actions**

The following strategies impact more than one jurisdiction. The first jurisdiction listed ranked the strategy as a high-priority action.

#### *James River*

<b>Strategy #6.4.1:</b> Develop a more advanced flood warning system to increase the ability to locally and specifically forecast flood events and flood depths. Partner with other organizations including the National Weather Service, United States Geological Survey and local watershed organizations.	
Affected Jurisdictions	City of Richmond, Goochland County, Hanover County
Category	Emergency Services
Hazard	Flood
Objective(s) addressed	6.4
Background	<p>Flood forecasting on the James River is complex. The current flood warning system does not provide enough information to effectively warn citizens of impending flooding. Additional flood gauges and other monitoring equipment are necessary to increase the ability of local government to understand the likelihood and extent of flood conditions.</p> <p>A more advanced flood warning system for the James River could include a public information component, such as real-time public web access to flood forecast information.</p>
Priority	High
Funding sources	United States Geological Survey (USGS); National Resource Conservation Service; Virginia Department of Conservation and Recreation
Responsible party	Office of Emergency Management; National Weather Service; USGS; local watershed organizations
Completion date	4 <sup>th</sup> quarter of 2007

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**Chickahominy River**

<b>Strategy #6.4.1:</b> Develop a more advanced flood warning system to increase the ability to locally and specifically forecast flood events and flood depths. Partner with other organizations including the National Weather Service, United States Geological Survey and local watershed organizations. <ul style="list-style-type: none"><li>• Work with the National Weather Service to install gauges along the Chickahominy River (coordinate this effort with New Kent County).</li></ul>	
Affected Jurisdictions	Charles City County; New Kent County
Category	Emergency Services
Hazard	Flood
Objective(s) addressed	6.4
Background	There is no flood warning system to monitor the Chickahominy River. The existing river gauges are not tied to a warning system. Charles City and New Kent counties should work together with the Department of Conservation and Recreation and the National Weather Service to develop and implement a flood warning system.
Priority	High
Funding sources	United States Geological Survey (USGS); National Resource Conservation Service
Responsible party	Public Works; VA DCR; National Weather Service; USGS; local watershed organizations
Completion date	4 <sup>th</sup> quarter of 2007

**Jurisdictional Actions**

Each jurisdiction selected and prioritized mitigation strategies for their jurisdiction. The top five to seven strategies for each jurisdiction are described in more detail. These strategies, combined with the regional strategies above, comprise the action plan for each jurisdiction.

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Charles City

<b>Strategy #6.1.2:</b> Develop recommendations for revenue sources for mitigation planning and projects.	
Affected Jurisdictions	Charles City County
Category	N/A
Hazard	All
Objective(s) addressed	6.1
Background	<p>Mitigation planning and projects are ongoing processes that require continual funding. Applications for funding available at the State and Federal levels need to be completed on an annual basis at a minimum. Each year this process needs to be reviewed to ensure funding is appropriate and sufficient.</p> <p>Sources of funding could include:</p> <p><i>Pre-Disaster:</i></p> <ul style="list-style-type: none"> <li>- Emergency Watershed Protection: USDA, Natural Resources Conservation Service (NRCS)</li> <li>- Water Resources: USDA, NRCS</li> <li>- Watershed Protection and Flood Prevention Program: USDA, NRCS</li> <li>- River Basin Project: USDA, NRCS</li> <li>- Land Protection: USDA, NRCS</li> <li>- Business and Industrial Loan Program: USDA, Rural Business Service</li> <li>- Watercourse Navigation: US Army Corps of Engineers</li> <li>- Pre-disaster Mitigation Program (PDM): FEMA</li> <li>- Wetlands Protection – Development Grants: EPA</li> <li>- Clean Water Act, Section 319 Grants: EPA</li> </ul> <p><i>Post-disaster:</i></p> <ul style="list-style-type: none"> <li>- Economic Adjustment Program: Economic Development Administration</li> </ul>

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	<ul style="list-style-type: none"><li>- Flood and Post-Flood Response, Emergency Operations: US Army Corps of Engineers</li><li>- Hazard Mitigation Grant Program (HMGP): FEMA</li><li>- Public Assistance (406 projects): FEMA</li><li>- Transportation, Emergency Relief Fund: Department of Transportation</li></ul> <p>Sources of funding other than State and Federal grants also should be explored. These may include public-private partnerships; foundation grants; and local bonds, dedicated fees and/or special taxes.</p>
Priority	High
Funding sources	N/A
Responsible party	Department of Development
Completion date	On-going

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<b>Strategy #6.3.2:</b> Identify means to coordinate, collect and store damage assessment data in GIS format for each natural hazard event, which causes death, injury and or property damage. <i>[on-going]</i>	
Affected Jurisdictions	Charles City County
Category	Emergency Services
Hazard	All hazards
Objective(s) addressed	6.3
Background	<p>Collecting and managing damage assessment information is essential to an effective response and mitigation effort. By determining what happened and what the impacts are, communities are in a better position to respond initially to a disaster and to request additional assistance (e.g., State or Federal). GIS systems can be used to effectively manage data and provide maps for emergency response planning and decision-making. This data analysis will help ensure that equipment and personnel can be better used, and assistance can be provided more quickly.</p> <p>This damage assessment information also can be used in future mitigation planning efforts. By capturing locally-specific accurate loss data, future hazard identification and risk assessments can be more detailed and accurate.</p>
Priority	High
Funding sources	Departmental funds, HMGP 5% funds
Responsible party	Department of Development; Public Works
Completion date	On-going

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<b>Strategy #6.3.3:</b> Identify training opportunities for staff to enhance ability to use GIS for emergency management needs. <i>[on-going]</i>	
Affected Jurisdictions	Charles City County
Category	Emergency Services
Hazard	All hazards
Objective(s) addressed	6.3
Background	<p>Emergency managers collect and manage a vast quantity of data -- before, during and after disasters. Much of this information comes from other departments and agencies and has a spatial component. Geographic Information Systems (GIS) provide a means to manage and share these datasets.</p> <p>Staff should continue to take opportunities to attend training to increase their knowledge of GIS and their application to emergency management.</p>
Priority	High
Funding sources	Departmental funds, FEMA
Responsible party	Fire and Rescue, Department of Development, Public Works
Completion date	1 <sup>st</sup> quarter of 2007

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<b>Strategy #6.4.2:</b> Investigate, develop, or enhance Reverse 911 system or other appropriate emergency communication system for citizens. <ul style="list-style-type: none"><li>• Upgrade the current system.</li></ul>	
Affected Jurisdictions	Charles City County
Category	Emergency Services, Public Information
Hazard	All hazards
Objective(s) addressed	6.4
Background	<p>Reverse 911 systems have a variety of functions including the ability to provide public warning during emergency events. This information can be targeted to a particular geographic area or to people with common characteristics (e.g., Community Emergency Response Team members). Some systems also allow communities to provide text messages to pagers and other wireless devices.</p> <p>This system greatly increases a community's ability to quickly and efficiently provide warnings to its citizens. Information can be delivered in a variety of languages and means.</p>
Priority	High
Funding sources	Homeland Security Grant Program
Responsible party	Police; Fire/EMS
Completion date	1 <sup>st</sup> quarter of 2007



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**Goochland**

<b>Strategy #2.3.*: Coordinate with City of Richmond to address wastewater capacity issues</b>	
Affected Jurisdictions	Goochland
Category	Emergency Services
Hazard	All hazards
Objective(s) addressed	2.3
Background	<p>The City of Richmond provides wastewater treatment to the eastern portion of Goochland County (Tuckahoe Creek Service District). After a natural disaster event (particularly a flood), the city's ability to receive and treat the county's wastewater is uncertain. Of particular concern to the county is the possibility that the county be held financially liable (via citation/fine) if untreated waste is released into the James River by the city.</p> <p>Additional retention or treatment capacity needs to be added to ensure that untreated waste is not released into the environment following a natural disaster.</p> <p>Note: Henrico County and the Virginia Department of Corrections provides wastewater treatment to the other areas of Goochland County that have access to public water treatment facilities.</p>
Priority	High
Funding sources	Capital Improvements Program
Responsible party	Public Works
Completion date	3 <sup>rd</sup> quarter of 2007

\* Action not included in original list.

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<b>Strategy #6.1.3:</b> Incorporate mitigation principles into local comprehensive, emergency management, and recovery plans.	
Affected Jurisdictions	Goochland
Category	Prevention
Hazard	All hazards
Objective(s) addressed	6.1
Background	While mitigation is a phase of the emergency management cycle, it can not be successfully implemented by emergency managers alone. The departments and agencies involved span planning, public works, economic development, and public safety. For mitigation to be truly successful, it must become part of local planning and decision-making. Mitigation concepts should be (or continue to be) integrated into local comprehensive, emergency management and recovery plans. As goals, objectives, and strategies are identified for these types of plans, efforts should be made to include mitigation explicit and implicitly.
Priority	High
Funding sources	N/A
Responsible party	County Administration, Planning, Fire and Rescue, Public Works
Completion date	On-going

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<b>Strategy #6.3.2:</b> Identify means to coordinate, collect and store damage assessment data in GIS format for each natural hazard event, which causes death, injury or property damage.	
Affected Jurisdictions	Goochland
Category	Emergency Services
Hazard	All hazard
Objective(s) addressed	6.3
Background	Collecting and managing damage assessment information is essential to an effective response and mitigation effort. By determining what happened, what the impacts are, communities are in a better position to respond initially to a disaster and to request additional assistance (e.g., state or federal). GIS systems can be used to effectively manage data and provide maps for emergency response planning and decision-making. This data analysis will help ensure that equipment and personnel can be better used, and assistance can be provided more quickly.
Priority	High
Funding sources	Departmental funds
Responsible party	Fire and Rescue, Planning Department, Building Department
Completion date	On-going

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<b>Strategy #6.3.3:</b> Identify training opportunities for staff to enhance ability to use GIS for emergency management needs.	
Affected Jurisdictions	Goochland
Category	Emergency Services
Hazard	All hazards
Objective(s) addressed	6.3
Background	<p>Emergency managers collect and manage a vast quantity of data -- before, during and after disasters. Much of this information comes from other departments and agencies and has a spatial component. Geographic Information Systems (GIS) provide a means to manage and share these datasets.</p> <p>Staff should continue to take opportunities to attend training to increase their knowledge of GIS and their application to emergency management.</p>
Priority	High
Funding sources	Departmental funds, FEMA
Responsible party	Fire and Rescue, Planning
Completion date	1 <sup>st</sup> quarter of 2007

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<b>Strategy #6.4.2:</b> Investigate, develop, or enhance Reverse 911 system or other appropriate emergency communication system for citizens.	
Affected Jurisdictions	Goochland
Category	Emergency Services, Public Information
Hazard	All hazards
Objective(s) addressed	5.1, 6.4
Background	<p>Reverse 911 systems have a variety of functions including the ability to provide public warning during emergency events. This information can be targeted to a particular geographic area or to people with common characteristics (e.g., Community Emergency Response Team members). Some systems also allow communities to provide text messages to pagers and other wireless devices.</p> <p>This system greatly increases a community's ability to quickly and efficiently provide warnings to its citizens. Information can be delivered in a variety of languages and means.</p>
Priority	High
Funding sources	Homeland Security Grant Program
Responsible party	Fire and Rescue, Sheriff
Completion date	1 <sup>st</sup> quarter of 2007

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**Hanover**

<b>Strategy #1.1.2:</b> Incorporate hazard mitigation techniques into new community facilities to minimize damages.	
Affected Jurisdictions	Hanover County
Category	Property protection
Hazard	Flood, wind, winter storm
Objective(s) addressed	1.1
Background	<p>The existing radio towers and other critical facilities have been subject to past damage from flood, wind and ice storms (see above strategy).</p> <p>When new community facilities are in the design stage, the potential impacts of natural hazards should be considered. Opportunities for mitigation measures should be taken at the earliest opportunity to ensure that new facilities are built to withstand natural disaster.</p>
Priority	High
Funding sources	PDM, HMGP, FEMA 406 funds (post-disaster), Capital Improvement Budget
Responsible party	County Engineer
Completion date	On-going

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<b>Strategy #1.2.2:</b> Investigate all primary and secondary schools to evaluate their resistance to natural hazards. Prioritize schools that are used as community shelters.	
Affected Jurisdictions	Hanover County
Category	Property protection
Hazard	Flood, wind, winter storm
Objective(s) addressed	1.2
Background	<p>Schools host a significant portion of the population during daytime hours. In addition, county schools are used as shelters in the event of a disaster. An audit should be conducted to ensure the structural integrity of these buildings in the event of a natural disaster.</p> <p>Action item:</p> <p>1) Liberty Middle School: This school is a designated shelter location. A back-up generator needs to be purchased for this site to ensure a continuous supply of electricity after an event. The school's structural integrity should be audited to determine if mitigation is needed. Pre-Disaster Mitigation (PDM) funds could be available to fund needed upgrades; a generator could be included as part of an overall PDM project.</p>
Priority	High
Funding sources	Hazard Mitigation Grant Program (HMGP); Pre-Disaster Mitigation Grant Program (PDM)
Responsible party	School Board; County Engineer
Completion date	4 <sup>th</sup> quarter of 2006

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<b>Strategy #1.2.3:</b> Investigate all critical community facilities, such as county administrative offices, shelters (non-school buildings), fire stations and police stations, to evaluate their resistance to hazards.	
Affected Jurisdictions	Hanover County
Category	Property protection
Hazard	Flood, wind, winter storm
Objective(s) addressed	1.2
Background	<p>The ability to recover quickly after a disaster rests, in part, on the community's ability to maintain critical functions during response and recovery. Several critical facilities are known to be vulnerable to natural hazards. A full inventory and evaluation should be conducted.</p> <p>Action Items:</p> <p>1) Sheriff's Office: The County's Sheriff's Office EOC logistic support center and briefing rooms are located in the basement of the Sheriff's office. The basement is prone to limited water damage primarily due to sealant issues. The basement should be retrofitted to prevent water damage.</p> <p>2) Radio tower protection: The county's radio towers (especially the Pole Green Park tower) have been subject to past damage from wind and ice storms. The Pole Green Park tower is used to relay signals between both sides of the county. Replacement parts for this tower are no longer available. The Pole Green Park tower should be replaced with a new tower that is better able to withstand wind and winter hazards. The remaining towers should be retrofitted or replaced as is cost-effective. New towers should be built to withstand high wind and winter storm loads.</p>
Priority	High



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Funding sources	Pre-Disaster Mitigation Grant Program (PDM); Homeland Security Grant Program
Responsible party	Sheriff; Fire/EMS; County Engineer
Completion date	4 <sup>th</sup> quarter of 2005

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<b>Strategy #3.2.2:</b> Staff Emergency Management (Sheriff/Fire), Building Inspections Office and Zoning Office at adequate levels.	
Affected Jurisdictions	Hanover County
Category	N/A
Hazard	All hazards
Objective(s) addressed	3.2
Background	<p>These offices have limited staff. Existing staff have multiple roles and responsibilities. The limited amount of staff affects ability to fully enforce existing regulations and to implement new programs. Additional staff is required.</p> <p>When an emergency occurs, staff quickly become overextended and may be unable to fulfill all duties from normal roles and emergency roles.</p>
Priority	High
Funding sources	County budget
Responsible party	Board of Supervisors; Department heads
Completion date	4 <sup>th</sup> quarter of 2006

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<b>Strategy #6.2.*:</b> Increase interoperability of communication systems with other jurisdictions.	
Affected Jurisdictions	Hanover County
Category	Emergency Services
Hazard	All hazards
Objective(s) addressed	6.2
Background	<p>Hanover County currently does not have the ability to communicate with neighboring jurisdictions using its existing radio system. This lack of interoperability hinders response abilities and information sharing between jurisdictions. In addition, the existing radio system has dead spots in the far eastern and western portions of the county.</p> <p>A bond referendum is planned for November 2005 to fund a new radio system.</p>
Priority	High
Funding sources	Homeland Security Grant Program; County bond
Responsible party	Sheriff; Fire/EMS
Completion date	2 <sup>nd</sup> quarter of 2006

\*Strategy not included in overall list.

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**Henrico**

<b>Strategy #1.2.1:</b> Develop comprehensive list of critical facilities within the county.	
Affected Jurisdictions	Henrico County
Category	Property protection
Hazard	All hazards
Objective(s) addressed	1.2
Background	<p>A comprehensive list of public and private critical facilities is essential for effective planning and response activities. Emergency managers must understand what facilities are at-risk in order to identify means to mitigate the risks and prioritize response actions.</p> <p>This analysis will include the structural integrity of the critical facilities and an evaluation of their ability to function in a post-disaster environment. Shortfalls or needed improvements will be identified as well as the means to address them. This may include identifying the need for back-up generators and hook-ups; communication equipment; or hazard retrofits.</p>
Priority	High
Funding sources	Pre-Disaster Mitigation Grant Program (PDM)
Responsible party	Fire Department; General Services Department/Facilities Management
Completion date	1 <sup>st</sup> quarter of 2006

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<b>Strategy #2.1.2:</b> Consider providing necessary electrical hook-up, wiring, and switches to allow readily accessible connections to emergency generators at key critical public facilities.	
Affected Jurisdictions	Henrico County
Category	Emergency Services
Hazard	All Hazards
Objective(s) addressed	2.1
Background	<p>Weather conditions throughout the year can cause unexpected power outages that effect critical public facilities. This can happen during thunder storms, hurricanes, winter storms and many other events.</p> <p>Generators are essential to providing reliable, immediate and full-strength power when primary power systems fail. Standby power is required for health care facilities, operations centers, food storage, essential building operations, correctional and security systems, water pumping stations, and 911 call centers.</p> <p>Generator hook-ups allow the county to have a supply of mobile generators that can be assigned based on needs (as opposed to buying a generator for each facility). In addition, these hook-ups ensure that if a generator is sent somewhere it can actually be used.</p>
Priority	High
Funding sources	Homeland Security Grant Program; Capital Improvements Plan; PDM
Responsible party	Fire Department, Public Works Department
Completion date	2nd quarter of 2006

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<b>Strategy #2.4.1:</b> Evaluate existing stormwater system to determine if it is adequate for existing (or future) flood hazard.	
Affected Jurisdictions	Henrico County
Category	Prevention
Hazard	Flood
Objective(s) addressed	2.4
Background	<p>Stormwater systems are used to hold back stormwater runoff to control flooding and settle out pollutants and debris, thereby improving water quality. The systems have many elements including catch basins, manholes, pipes, drywells, and detention systems.</p> <p>A stormwater system is designed for a certain capacity based on the projected runoff. As communities grow, the amount of runoff may increase and eventually exceed the amount that the system was designed to handle. Additional capacity may be needed to handle the increased runoff.</p> <p>The recent and anticipated growth in Henrico County may push the existing stormwater system beyond its capacity.</p>
Priority	High
Funding sources	Capital Improvements Program
Responsible party	Public Works Department
Completion date	4 <sup>2nd</sup> quarter of 2006

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<b>Strategy #4.2.3:</b> Identify existing flood-prone structures that may benefit from mitigation measures such as elevation.	
Affected Jurisdictions	Henrico County
Category	Property Protection
Hazard	Flood
Objective(s) addressed	4.2
Background	<p>There are fifteen repetitive flood loss properties in Henrico County as of 12/31/03, according to FEMA. The majority of these structures are single-family residences. There are likely additional flood-prone structures in the county.</p> <p>The county should use GIS and past damage information to identify specific properties that may benefit from property protection measures. These measures include relocation or elevation. Dry or wet floodproofing may be options for non-residential structures.</p> <p>Other measures, such as elevation of appliances such as heating/air conditioning units, also may be appropriate.</p>
Priority	High
Funding sources	FEMA HMGP; FEMA PDM; Community Development Block Grant/Virginia Disaster Recovery Program
Responsible party	Fire Department; Community Revitalization
Completion date	2 <sup>nd</sup> quarter of 2006

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<b>Strategy # 5.1.3:</b> Work with the National Weather Service to promote the “Turn Around, Don’t Drown” public education campaign.	
Affected Jurisdictions	Henrico County
Category	Public Information and Awareness
Hazard	Flood
Objective(s) addressed	5.1
Background	<p>Flooding causes more deaths than any other severe weather related hazard. Many of the deaths occur in automobiles as they are swept away by floodwaters. The Richmond region has seen its share of driver and passenger fatalities.</p> <p>The National Weather Service has developed a public education campaign, “Turn Around, Don’t Drown,” to educate drivers about the hazards flood waters pose.</p> <p>A range of public education materials, such as brochures, signs, and Public Service Announcements, already have been developed by the National Weather Service for use by its local office and local government.</p>
Priority	High (Note: this strategy is also included in the regional action plan section)
Funding sources	National Weather Service
Responsible party	County Public Information Officer
Completion date	Six months after plan approval



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**New Kent**

<b>Strategy #1.1.2:</b> Incorporate hazard mitigation techniques into new community facilities to minimize damages.	
Affected Jurisdictions	New Kent County
Category	Property protection
Hazard	Flood, wind, winter storm
Objective(s) addressed	1.1
Background	When new community facilities are in the design stage, the potential impacts of natural hazards should be considered. Opportunities for mitigation measures should be taken at the earliest opportunity to ensure that new facilities are built to withstand natural disaster.
Priority	High
Funding sources	Local
Responsible party	County Engineer
Completion date	On-going

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<b>Strategy #2.1.1:</b> Identify need for backup generators, communications and/or vehicles at critical public facilities. Develop means to address shortfall identified.	
Affected Jurisdictions	New Kent County
Category	Emergency Services
Hazard	All hazards
Objective(s) addressed	2.1
Background	<p>The ability to recover quickly after a disaster rests, in part, on the community's ability to maintain critical functions during response and recovery. An important part of maintaining these critical functions is ensuring that the facilities and resources needed are operational after a disaster.</p> <p>An inventory and assessment should be completed for critical community facilities (e.g., Emergency Operations Center, Emergency Communications Center, public shelters) that examines the need for backup generators, communications and/or vehicles. Needs should be ranked and a plan developed to address the most critical needs first.</p>
Priority	High
Funding sources	Capital Improvements Program, FEMA HMGP 5% funds, PDM
Responsible party	Department of Emergency Management, Public Works
Completion date	2 <sup>nd</sup> quarter of 2006

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<b>Strategy #2.2.*:</b> Elevate or pursue other floodproofing of road in Fannies Creek area.	
Affected Jurisdictions	New Kent County
Category	Property Protection
Hazard	Flood
Objective(s) addressed	2.2
Background	<p>Fannies Creek at State Route 627 poses a threat to public safety. The road is the only ingress/egress for the Chickahominy Shores and Turner's Neck subdivisions and the Colonial Harbor Marina and Campground. The road floods after any significant rainfall event and also may flood if there is an abnormal high tide. Residents of approximately 120 homes are potentially affected.</p> <p>Elevation or other floodproofing of this road has been considered in the past by the county. The project should be added to the county's requests and recommendations for the Virginia Department of Transportation's Six Year Improvement Plan.</p>
Priority	High
Funding sources	VDOT; FEMA HMGP; FEMA FMA; FEMA PDM
Responsible party	Virginia Department of Transportation; County Administration
Completion date	4 <sup>th</sup> quarter of 2007

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<b>Strategy #2.4.1</b> Evaluate existing stormwater system to determine if it is adequate for existing (or future) flood hazard.	
Affected Jurisdictions	New Kent County
Category	Prevention
Hazard	Flood
Objective(s) addressed	2.4
Background	<p>Stormwater systems are used to hold back stormwater runoff to control flooding and settle out pollutants and debris, thereby improving water quality. The systems have many elements including catch basins, manholes, pipes, drywells, and detention systems.</p> <p>A stormwater system is designed for a certain capacity based on the projected runoff. As communities grow, the amount of runoff may increase and eventually exceed the amount that the system was designed to handle. Additional capacity may be needed to handle the increased runoff.</p> <p>The recent and anticipated growth in New Kent County may push the existing stormwater system beyond its capacity.</p>
Priority	High
Funding sources	Capital Improvements Program
Responsible party	Public Utilities
Completion date	4 <sup>2nd</sup> quarter of 2006

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<b>Strategy #3.2.2:</b> Staff Emergency Management, Planning, Building Inspections and Zoning Offices at adequate levels.	
Affected Jurisdictions	New Kent County
Category	N/A
Hazard	All hazards
Objective(s) addressed	3.2
Background	<p>These offices have limited staff. Existing staff have multiple roles and responsibilities. The limited amount of staff affects ability to fully enforce existing regulations and to implement new programs. Additional staff is required.</p> <p>When an emergency occurs, staff quickly become overextended and may be unable to fulfill all duties from normal roles and emergency roles.</p>
Priority	High
Funding sources	County budget
Responsible party	Board of Supervisors; Department heads
Completion date	4 <sup>th</sup> quarter of 2006

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**Powhatan**

<b>Strategy #2.1.*:</b> Purchase two mobile emergency generators and install electrical hookups to connect these generators at key facilities.	
Affected Jurisdictions	Powhatan County
Category	Emergency Services
Hazard	All hazard
Objective(s) addressed	2.1
Background	<p>None of the counties' potential emergency shelters have emergency power supplies (i.e., generators). In addition, there are several key public facilities (e.g., Powhatan County Administration Building) that do not have emergency generators.</p> <p>Mobile generators will provide a cost-effective and flexible means of providing back-up emergency power. The mobile generators can be transported to the location of evacuation shelters or to other key locations where they may be needed. In addition, hook-ups will need to be installed at these key locations to facilitate use of these generators.</p>
Priority	Medium
Funding sources	Homeland Security Grant Program; Powhatan County Capital Improvements Plan
Responsible party	Powhatan County Department of Emergency Management
Completion date	July 1, 2008

\*Strategy not included in overall list.

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<b>Strategy #3.2.1:</b> Continue to enforce codes to prevent construction in floodplain.	
Affected Jurisdictions	Powhatan County
Category	Prevention
Hazard	Flood
Objective(s) addressed	3.2
Background	<p>Powhatan implemented restrictions on construction within the floodplain over thirty years ago. The enforcement of this regulation has resulted in no occupied structures within the floodplain, significantly reducing the county's vulnerability to flooding.</p> <p>By continuing to prohibit construction in the floodplain, the county will reduce the need for future response and recovery actions.</p>
Priority	High
Funding sources	Departmental budget
Responsible party	Powhatan County Department of Planning and Community Development
Completion date	On-going

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<b>Strategy #5.1.2:</b> Work with VDOT to establish flood level markers along bridges and other structures to indicate the rise of water levels along creeks and rivers in potential flood-prone areas.	
Affected Jurisdictions	Powhatan County
Category	Public Information and Awareness
Hazard	Flood
Objective(s) addressed	5.1
Background	<p>Many of the deaths that occur during flood events occur when people attempt to drive through floodwaters.</p> <p>There are several points on roadways in Powhatan County (in particular, Rocky Ford Road) that are subject to localized flooding during heavy rains.</p> <p>The intent of this project is to provide signs that will call attention to the potential for flooding and provide a gauge indicating the level of the water during flooding events.</p>
Priority	Medium
Funding sources	Hazard Mitigation Grant Program (HMGP), VDOT, local funds
Responsible party	Powhatan County Department of Emergency Management; Virginia Department of Transportation
Completion date	July 1, 2006



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<b>Strategy #6.2.1: Develop a Continuity of Operations Plan</b>	
Affected Jurisdictions	Powhatan County
Category	Emergency Services
Hazard	All Hazards
Objective(s) addressed	6.2
Background	<p>The ability of state and local governments to carry out their executive, legislative and judicial functions effectively and efficiently during or following a disaster or emergency is dependent on sound preparedness and planning. The development and maintenance of a viable Comprehensive Continuity Plan (CCP) and capability at each level of government is critical to save lives, and protect the public health and well-being, protect property and preserve assets, maintain functionality, and maintain essential government operations and services.</p> <p>Powhatan County does not have a Continuity of Operations Plan. This plan will be developed in conjunction with the upcoming rewriting of the Powhatan County Emergency Operations Plan.</p>
Priority	Medium
Funding sources	Departmental budget. Minimal funding will be required for this project.
Responsible party	Powhatan County Department of Emergency Management
Completion date	September 30, 2005

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<b>Strategy #6.3.1:</b> Work with the RRPDC to develop a detailed building inventory for all structures in the county, in a GIS-based format, which catalogues information regarding assets such as value of structure, contents, age, location (latitude and longitude), etc.	
Affected Jurisdictions	Powhatan County
Category	Prevention / Public Information and Awareness
Hazard	All hazards
Objective(s) addressed	6.3
Background	<p>Powhatan County does not have a GIS data system. This hampers our ability to assist citizens during day-to-day work, especially during significant emergencies where citizens are in peril.</p> <p>The Planning District Commission is experienced in providing assistance to counties in developing a GIS program including data development. Powhatan County will benefit from this experience.</p>
Priority	High
Funding sources	Local
Responsible party	Powhatan County Department of Planning and Community Development; Powhatan County Department of Emergency Management
Completion date	3 <sup>rd</sup> quarter of 2006

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**City of Richmond**

<b>Strategies #1.2.1-3</b> Develop comprehensive list of public and private critical facilities and their equipment (i.e., communication-related, back-up generators and vehicles, etc.) including all primary and secondary schools and evaluate for resistance to all natural hazards. Develop means to address shortfalls identified.	
Affected Jurisdictions	City of Richmond
Category	Property protection
Hazard	All hazards
Objective(s) addressed	1.2
Background	<p>A comprehensive list of public and private critical facilities is essential for effective planning and response activities. Emergency managers must understand what facilities are at-risk in order to identify means to mitigate the risks and prioritize response actions.</p> <p>This analysis will include the structural integrity of the critical facilities and an evaluation of their ability to function in a post-disaster environment. Shortfalls or needed improvements will be identified as well as the means to address them. This may include identifying the need for back-up generators and hook-ups; communication equipment or hazard retrofits.</p>
Priority	High
Funding sources	Pre-Disaster Mitigation Grant Program (PDM)
Responsible party	City of Richmond Office of Emergency Management; Richmond Public Schools
Completion date	1 <sup>st</sup> quarter of 2006

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<b>Strategies #2.4.1-3:</b> Conduct a study of the storm sewer system/Shockoe Bottom (James River floodwall) and impact on CSO ability to handle massive rainfall for existing or future flood threats including underground streams.	
Affected Jurisdictions	City of Richmond
Category	Structural Projects
Hazard	Flood
Objective(s) addressed	2.4
Background	<p>The Richmond Flood Wall, completed in 1997, has greatly reduced the risk of river flooding in riverfront areas of the city. The intense rainfall caused by Tropical Storm Gaston demonstrated that flooding is still possible in these areas. Concern has been raised that the floodwall contributed to the extent of the flooding.</p> <p>The storm sewer system in the Shockoe Bottom area may not be adequate to handle large-scale stormwater events. A study should be conducted to determine the impact of the floodwall on future flooding and to determine what inadequacies exist in the current storm sewer system.</p>
Priority	High
Funding sources	PDM; Flood Mitigation Assistance (FMA); HMGP; FEMA post-disaster funds
Responsible party	City of Richmond Public Works
Completion date	2 <sup>nd</sup> quarter of 2006

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<b>Strategy #2.4.4:</b> Develop and implement a channel maintenance program consisting of routine inspections and subsequent debris removal to ensure free flow of water in local streams and watercourses.	
Affected Jurisdictions	City of Richmond
Category	Structural Projects, Natural Resource Protection
Hazard	Flood
Objective(s) addressed	2.4
Background	<p>Waterways should be cleared of debris to allow for the free flow of water during a flood event. If streams or rivers are clogged with debris, damming could occur. As a result, areas upstream and adjacent to the unintended dam can receive unanticipated higher flood levels. In addition, downstream areas may be vulnerable to higher flooding if and when the dam breaks.</p> <p>Shockoe Creek is of particular concern to the city because of its potential for flooding and the impact it could have on structures. Coordination with state and federal regulatory agencies would be required for implementation.</p>
Priority	Medium
Funding sources	Local
Responsible party	City of Richmond Public Works
Completion date	3 <sup>rd</sup> quarter of 2006

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<b>Strategy #6.2.1: Develop a Continuity of Operations Plan</b>	
Affected Jurisdictions	City of Richmond
Category	Emergency Services
Hazard	All Hazards
Objective(s) addressed	6.2
Background	<p>The ability of state and local governments to carry out their executive, legislative and judicial functions effectively and efficiently during or following a disaster or emergency is dependent on sound preparedness and planning. The development and maintenance of a viable Comprehensive Continuity Plan (CCP) and capability at each level of government is critical to save lives, and protect the public health and well-being, protect property and preserve assets, maintain functionality, and maintain essential government operations and services.</p> <p>The City of Richmond does not have a Continuity of Operations Plan.</p>
Priority	Medium
Funding sources	Departmental budget.
Responsible party	City of Richmond Department of Emergency Management
Completion date	1 <sup>st</sup> quarter of 2005

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<b>Strategy #6.4.2:</b> Investigate, develop, or enhance Reverse 911 system or other appropriate emergency communication system for citizens.	
Affected Jurisdictions	City of Richmond
Category	Emergency Services, Public Information
Hazard	All hazards
Objective(s) addressed	6.4
Background	<p>Reverse 911 systems have a variety of functions including the ability to provide public warning during emergency events. This information can be targeted to a particular geographic area or to people with common characteristics (e.g., Community Emergency Response Team members). Some systems also allow communities to provide text messages to pagers and other wireless devices.</p> <p>This system greatly increases a community's ability to quickly and efficiently provide warnings to its citizens. Information can be delivered in a variety of languages and means.</p>
Priority	Medium
Funding sources	Homeland Security Grant Program
Responsible party	Office of Emergency Management; Police; Fire/EMS
Completion date	1 <sup>st</sup> quarter of 2007

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<b>Strategy #6.* Establish a dedicated funding stream for emergency storm program.</b>	
Affected Jurisdictions	City of Richmond
Category	N/A
Hazard	Flood, wind, winter storm
Objective(s) addressed	6.1, 6.2, 6.4
Background	<p>The Department of Public Works receives an annual allocation for snow removal. This allocation also is used for debris removal from wind and ice events.</p> <p>The yearly allocation is often insufficient though there are some years when a surplus occurs. Rollover of leftover funds is not currently allowed. A consistent source of funding, or multi-year funding, is required.</p>
Priority	Medium
Funding sources	Local
Responsible party	Public Works; Office of Emergency Management
Completion date	3 <sup>rd</sup> quarter of 2006

\*Strategy not included in overall list.



## **Section VIII. PLAN MAINTENANCE PROCEDURES**

The long-term success of the Richmond Regional Hazard Mitigation Plan depends in large part on routine monitoring, evaluating, and updating of the plan so that it will remain a valid tool for the communities to use. The first step in ensuring that the plan's activities will be implemented is to continue the Mitigation Advisory Committee to facilitate coordination and implementation of plan elements, and to help institutionalize and develop an ongoing mitigation program as proposed in Mitigation Strategy 6.1.1.

### ***Plan Adoption, Implementation and Maintenance***

#### **Formal Plan Adoption**

(Note: this is written as if the adoptions have already occurred)

Seven local governments in central Virginia participated in this planning process and formally adopted this plan by resolution of their governing Board. These local governments are the counties of Charles City, Goochland, Hanover, Henrico, New Kent, and Powhatan counties, the City of Richmond, and the Town of Ashland. Plan development was coordinated by the Richmond Regional Planning District Commission staff. Sample adoption language was provided to the participating jurisdictions to facilitate the adoption process (see Appendix A). Jurisdictions were asked to adopt the portions of the plan that applied to the region and to their specific jurisdiction.

The adoption process itself took several months, as significant coordination by the Mitigation Advisory Committee was necessary in order to 1) get the plan review and adoption on the appropriate meeting agendas in each jurisdiction, 2) produce and provide copies in official meeting packets, 3) facilitate the actual adoption, 4) collect the adoption resolutions, and 5) incorporate the adopted resolutions into the final Hazard Mitigation Plan.

The Richmond Regional Planning District Commission appreciates the willingness that both Virginia Department of Emergency Management and FEMA Region III demonstrated by reviewing this plan concurrently and providing comments for revision *prior* to the adoption process.

#### **Implementation**

Upon adoption, the plan faces the biggest test: *implementation*. While this plan puts forth many worthwhile and “High” priority recommendations, the decision of what actions to undertake first will be the primary issue that the Richmond Regional Planning District communities face.

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Funding is always an important and critical issue. Therefore, pursuing low or no-cost high-priority recommendations may be one approach that a community chooses to take. An example of a low-cost, high-priority recommendation would be to work with local media outlets to raise awareness about the risks posed by natural hazards and educate citizens on means to reduce their vulnerability.

Another implementation approach is to prioritize those actions that can be completed in a relatively short amount of time. Being able to publicize a successful project can build momentum to implement the other parts of the plan. An example of an effective but easy-to-implement strategy is to purchase NOAA weather radios for school administrative offices.

It is important to the long-term implementation of the plan that the underlying principles of this Hazard Mitigation Plan are considered and incorporated whenever possible into other community plans and mechanisms, such as:

- Comprehensive Plan
- Capital Improvement Plan

The capability assessment section of this plan provides insight into the current comprehensive plans for each community. Communities should work to ensure that the appropriate information from this plan is incorporated into the next update of their comprehensive plan or other appropriate local plans. Information from the hazard identification and risk assessment as well as mitigation goals and strategies can be directly included as a comprehensive plan element. Projects that require large investments, such as acquisition or road retrofits are candidates for inclusion in capital improvement plans.

Mitigation is most successful when it is incorporated within the day-to-day functions and priorities of government and development. This integration is accomplished by a constant effort to network and to identify and highlight the multi-objective, “win-win” benefits to each program, the communities and their constituents. This effort is achieved through the actions of monitoring agendas, attending meetings, and sending memos.

Simultaneous to these efforts, it is important to constantly monitor funding opportunities that can be utilized to implement some of the higher cost recommended actions. This will include creating and maintaining a repository of ideas on how any required local match or participation requirement can be met. Then, when funding does become available, the community will be in a position to take advantage of an opportunity. Funding opportunities that can be monitored include special pre- and post-disaster funds, special district budgeted funds, state or federal ear-marked funds, and grant programs, including those that can serve or support multi-objective applications.

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With adoption of this plan, the Richmond Regional Planning District Commission communities commit to:

- Pursuing the implementation of the high-priority, low/no-cost recommended actions.
- Keeping the concept of mitigation in the forefront of community decision-making by considering and incorporating whenever possible the recommendations of the Hazard Mitigation Plan when other community goals, plans and activities are discussed and decided upon.
- Maintaining a constant monitoring of multi-objective, cost-share opportunities to assist the participating communities in implementing the recommended actions of this plan for which no current funding or support exists.

### **Maintenance**

Plan maintenance requires an ongoing effort to monitor and evaluate the implementation of the plan, and to update the plan as progress, roadblocks, or changing circumstances are recognized.

This monitoring and updating will take place through:

- Annual progress reports from each jurisdiction on their Mitigation Action Plan,
- An annual review by the Mitigation Advisory Committee, and
- A 5-year written update to be submitted to the state and FEMA Region III, unless disaster or other circumstances (e.g., changing regulations) lead to a different time frame.

Based on preliminary discussions by the Mitigation Advisory Committee, the Richmond Regional Planning District Commission with continuous input from the various localities could be responsible for monitoring this plan. The Mitigation Advisory Committee representative from each jurisdiction could make annual updates to the Richmond Regional Planning District Commission on the progress of the implementation of their Mitigation Action Plans. The timing of the yearly reports could coincide with either the anniversary of the approval date of this plan or another date chosen by the committee, such as the anniversary of a significant event (e.g., Hurricane Isabel). The annual progress reports will be reviewed by the Mitigation Advisory Committee who will recommend what action is needed.

Under this scenario, the Mitigation Advisory Committee would be responsible for setting annual measures of success and a five-year measure of success for each strategy. These indicators can be used to measure the progress and success of implementation of the mitigation plan. The Mitigation Advisory Committee can use this information to determine

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if additional actions are needed. In addition, the Mitigation Advisory Committee should review the composition of the committee annually and add members if needed.

The Mitigation Advisory Committee will determine at the annual meeting if an update of the plan is needed. At a minimum, the plan will be updated every five years. Factors to consider when determining if an update is necessary include:

- Lessened vulnerability as a result of implementing recommended actions,
- Increased vulnerability as a result of failed or ineffective mitigation actions, and/or,
- Increased vulnerability as a result of new development (and/or annexation).
- New state/federal laws, policies, or programs
- Changes in resource availability
- Applicability of goals/objectives/strategies

A major event, such as a Presidentially-declared disaster, may trigger a need to review the plan. If such an event occurs in the Richmond region, the Mitigation Advisory Committee should identify how best to review and update the plan. The updating of the plan will be by written changes and submissions, as the Richmond Regional Planning District communities and Mitigation Advisory Committee deem appropriate. Major changes to the plan must be submitted to the state and to FEMA Region III for review and approval. Public notice will be given and public participation will be invited, at a minimum, through available web postings and press releases to the local media outlets, primarily newspapers and radio stations.

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***Data Sources for Maps***

- Charles City County: Commissioner of the Revenue
- Goochland County: Zoning, property values and acreage - Commissioner of the Revenue; Building points - developed by Woolpert, maintained by Goochland County
- Henrico County: Zoning - Henrico County Planning Department. Parcels - Henrico Department of Finance. Structures - developed by Merrick Inc, provided by the county
- Hanover County and the Town of Ashland: Hanover County Planning Department, Land Records and Mapping GIS
- New Kent County: Addresses determined based on 2002 VGIN Orthography, building permits and the tax assessor's database
- Powhatan County: Land use/zoning was digitized by the Richmond Regional Planning District Commission based on a hand drawn map provided by the county
- City of Richmond: GIS data provided by the city. Parcel data created by Michael Baker Jr. Corporation Inc. based on orthophotography and scanned/registered "keycard" images. Land use data created by city GIS staff based on Vector GIS Parcel Layer, Tax Assessor Office *Pro Val Database*, and "General Land Use" look-up-table. Structure data based on created by Michael Baker Jr. Corporation Inc. based on Orthophotography and updated with submitted site plans. Zoning created by city GIS staff based on scanned/registered keycard images, orthophotography and hardcopy zoning maps.
- Flood Insurance Rate Maps – Federal Emergency Management Agency, National Flood Insurance Program; digitized by the Richmond Regional Planning District Commission
- Demographic statistics - U.S. Census Bureau
- Repetitive loss structures - Virginia Department of Emergency Management
- Roads – Virginia Department of Transportation

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